4.0 ASSESSMENT RATIO STUDIES

The assessor has the difficult task of preparing an annual assessment roll that accurately reflects the value of all taxable property within the jurisdiction. The assessor is charged with valuing real property (with the exception of agricultural land) at market value.

Market Value Definition:
Section 137.115, RSMo, requires that property be assessed based upon its true value in money which is defined as the price a property would bring when offered for sale by one willing or desirous to sell and bought by one who is willing or desirous to purchase but who is not compelled to do so (1). True value in money is defined in terms of value in exchange and not value in use (2). It is the fair market value of the subject property on the valuation date (3). Market value is the most probable price in terms of money which a property should bring in competitive and open market under all conditions requisite to a fair sale, the buyer and seller, each acting prudently, knowledgeable and assuming the price is not affected by undue stimulus.

Implicit in this definition are the consummation of a sale as of a specific date and the passing of title from seller to buyer under conditions whereby:

1. Buyer and seller are typically motivated.

2. Both parties are well informed and well advised, and both acting in what they consider their own best interests.

3. A reasonable time is allowed for exposure in the open market.

4. Payment is made in cash or its equivalent.

5. Financing, if any, is on terms generally available in the Community at the specified date and typical for the property type in its locale.

6. The price represents a normal consideration for the property sold unaffected by special financing amounts and/or terms, services, fees, costs, or credits incurred in the transaction (4).

---

1 *St. Joe Minerals Corp. v. State Tax Commission, 854 S.W.2d 526, 529 (Mo. App. E.D. 1993); Missouri Baptist Children's Home v. State Tax Commission, 867 S.W.2d 510, 512 (Mo. banc 1993)*
2 *Daly v. P. D. George Company, et al*, 77 S.W.3d 645, 649 (Mo. App E.D. 2002), citing, *Equitable Life Assurance Society v. STC*, 852 S.W.2d 376, 380 (Mo. App. 1993); citing, *Stephen & Stephen Properties, Inc. v. STC*, 499 S.W.2d 798, 801-803 (Mo. 1973)
3 *Hermel, Inc. v. STC, 564 S.W.2d 888, 895 (Mo. banc 1978); Chicago, Burlington & Quincy Railroad Co. v. STC, 436 S.W.2d 650, 656 (Mo. 1968); May Department Stores Co. v. STC, 308 S.W.2d 748, 759 (Mo. 1958)*
4 *Real Estate Appraisal Terminology, Society of Real Estate Appraisers, Revised Edition,1984; See also, Real*

The property tax system is fair and equitable when the assessor produces accurate assessments. The accuracy of appraisals that form the basis for assessments is, therefore, of great concern to the assessor, property owners, political subdivisions (taxing entities), elected officials, and the State Tax Commission. The State Tax Commission Ratio Studies are the fundamental instruments used to measure the accuracy of real property assessments.

4.1 MISSOURI RATIO STUDY'S REQUIREMENTS & CONCEPTS

Ratio studies determine the level and uniformity of assessment by comparing the assessor's value to a market value proxy. As of January 1, 2011 there were approximately 3.28 million parcels of real estate within the State of Missouri. As it is not feasible to test the relationships that exist between the assessor's value and market value for every taxable parcel in the state, the Commission employs a sampling process that compares a statistically valid number of parcels from each county in order to make statistical inferences about the total population of parcels in each county. In a ratio study, the county's assessment is either compared to the sale price for recent transactions (sales ratio study) or the county's assessment is compared to an independent appraisal (appraisal ratio study.) Both are recognized procedures to determine if property tax assessments are fair and equitable.

Ratio studies have a variety of uses. At the local level, they can be used to:

1. Monitor assessment performance and thereby identify potential problems with assessment procedures;
2. Improve assessment equity by monitoring the overall level of assessment and the degree of dispersion;
3. Indicate the need for a general reappraisal, or a selective reappraisal of certain property types, groups or neighborhoods; and
4. Assist in market analysis.

At the state level, they can be used:

1. To monitor assessment accuracy;
2. For inter-county and intra-county equalization;
3. To distribute intergovernmental funds, such as the distribution of state funds to local school districts;
4. To determine the need for a general reassessment;
5. To establish priorities for reappraisal of selected groups of properties;
6. To compute an estimate of the market value of taxable property within a jurisdiction;
7. To adjust appraisals for centrally assessed properties; and
8. To evaluate claims of discrimination within the assessment function.

Estate Valuation in Litigation, J. D. Eaton, M.A.I., American Institute of Real Estate Appraisers, 1982, pp. 4-5; Property Appraisal and Assessment Administration, International Association of Practice, Glossary.

The end product of a ratio study is that the descriptive statistics allow the analyst to summarize the status of the valuations and to draw conclusions about the tested population.

1. BACKGROUND

As early as 1955 the general assembly created statutes that required the State Tax Commission to determine the general level of assessment in each of the state's 114 counties and the City of St. Louis. Over the years, a number of methods have been employed to establish assessment ratios through varying endeavors and with varied results.

In 1975, the State Auditor conducted a statewide sale ratio study to measure the assessment levels of the 114 counties and the City of St. Louis. The study showed a range of ratios from a low of 6.2% to a high of 46.7%. The problems inherent in a one-year sale ratio study subjected the study to considerable criticism; but if nothing else, the report served to point out the fact that there were obviously large disparities among the assessment levels of the counties. As a result of these studies, the legislature directed the Commission to formulate a supportable program to be used to measure the accuracy of the assessment process throughout the state.

In 1977, the Commission contracted with the Arthur Young & Company to develop a methodology for conducting statistically valid ratio studies and assisting the Commission in fulfilling its responsibilities and objectives of monitoring the property tax system.

In 1979, the State Supreme Court, in Cassily vs. Riley, ordered the Commission to conduct a statewide reassessment. Subsequently each county was directed to plan and implement a reassessment program in order to eliminate the deficiencies in the assessment process.

In 1985, the Commission contracted with the University of Missouri-Columbia to review the Commission's ratio study methodology and to recommend changes. The analysis found the policies and procedures of the state's study to be consistent with accepted statistical practices. The policies, procedures, and methodology of conducting the studies were also found to be in compliance with the "Standard on Ratio Studies" as published by the International Association of Assessing Officers (IAAO).

In 2006, the Commission contracted with the IAAO to re-examine the policies, procedures and methodology of the Commission's ratio study and to recommend improvements that would allow the Commission to better evaluate the state's level of assessment and to provide improved guidance to county assessors to ensure that assessments remain current.

In 2007, based on the IAAO recommendations, the Commission began using sales ratio studies

for residential property, including the Traditional Sales Study and the Progressive Hybrid Study. These sales ratio studies replaced the appraisal ratio studies in counties that showed quality sales databases, historically and prospectively.

A. MISSOURI RATIO STUDY TECHNICAL ADVISORY GROUP

The Missouri Ratio Study Technical Advisory Group (MRSTAG) was formed in 2010 to advise the Commission on its ratio study processes and procedures.

The purpose of the Missouri Ratio Study Technical Advisory Group is to review ratio study procedures, discuss relevant issues, and assist the State Tax Commission of Missouri with policies and procedures concerning the ratio study.

Committee Makeup:
The Missouri Ratio Study Technical Advisory Group is made up of individuals with a broad background in statistics, ratio studies, appraisal and assessment. The members are approved by the Commission.

The group is comprised of up to five (5) members, in addition to any STC members; one of the five members will be a sitting assessor as a representative of the Missouri State Assessors Association.

Ratio Study Management and the Ratio Study Statistician are permanent members of the committee; the Ratio Study Manager serves as Chair of the committee. Other STC personnel may participate in meetings when appropriate.

The members serve on the MRSTAG on a voluntary basis with no monetary benefit to any member. As of January 1, 2016, the Committee Members were:

Dr. Wade Davis
PhD Statistician

Dr. Elbert B. Whorton, Jr.
Univ. of Texas (retired); StatCom
PhD Statistician

Dr. Thomas Hamilton
Roosevelt University
PhD Real Estate and Urban
Land Economics

Hon. Tom Schauwecker
Boone County Assessor
MSAA Representative

Ms. Kristen Solindas
MO State Tax Commission
B.S. (Statistics); Statistician

Mr. Jeff Schmidt
MO State Tax Commission
Local Assistance Asst. Mgr.

Mrs. Jan Elliott, Chair
MO State Tax Commission
Local Assistance Manager

2. RESPONSIBILITIES AND OBJECTIVES

The State Tax Commission of Missouri, as the oversight agency of the assessment function in Missouri, is charged with the responsibility of monitoring the assessment accuracy in each of the 114 counties and the City of St. Louis. This is accomplished by a periodic Assessment Ratio Study.

The current analysis is based upon the accepted concepts for statistically valid studies.

- Sales studies measure marketable subsets of the entire population and are tested for reliability and adherence to professional standards.
- Appraisal studies employ a simple random, representative sample. The sampling methodology currently employed by the Commission identifies the population within each county and subclass. From this population, a random sample is drawn. Appraisals are then completed by the Commission's staff appraisers to estimate the Market Value for the property. Approximately 25 to 30 parcels are appraised in each subclass.
- Hybrid studies combine sales and appraisals for overall results.

The objective is to accurately estimate the overall level and uniformity of assessment for each specified subclass of property to determine compliance with constitutional, statutory, and departmental rule requirements.

3. RATIO STUDY CYCLE

In 1989, the Commission implemented a two (2) year ratio study cycle in place of an annually conducted study; previously, all subclasses in each of the 115 jurisdictions were completed each year. A two-year ratio study cycle provides several benefits as compared to an annual cycle:

a. It balances the appraisal workload over a longer time period thereby improving the work product. The appraisers have more time to research the market for the data necessary to support their value conclusions.
b. The supplementary time allows for conducting additional market studies (land analysis studies, cost studies, depreciation studies, etc.). These and other in-depth studies are most helpful in the proper valuation of real property.
c. It allows an appropriate amount of time to perform sales studies and allows for control groups of sales occurring after the date of value (January 1, odd year).

Beginning with the 2001 cycle, agricultural studies were scheduled for completion every six years. That is, one-third of the agricultural subclass studies were scheduled for completion during each two year cycle. This practice was deemed necessary due to budget and staffing

reductions. Then, in the 2007 cycle, Agricultural ratio studies were suspended altogether due to another round of budget and staff reductions. The reasoning in the Commission's decision lies in the nature of the agricultural assessment process.

Agricultural land is assessed based on "use value" not market value as are residential and commercial real estate. The grading and classification of agricultural land is based on observations of the topography, potential for flooding, tree cover and the quality and productivity of the underlying soil. The productivity rating for developing these classifications does not consider the market value of the land; therefore an increasing land value does not translate to an increase in land productivity. Since there is less likelihood of rapid changes in agricultural use value, the original decision to spread these studies over a longer time-frame was deemed reasonable. Paramount in the decision to suspend studies in 2007 was the stable nature of agricultural property productivity values with minimal changes over time, and consideration of the cost benefit analysis, wherein the required resources to do appraisal studies greatly exceeds any notable impact on the assessment process. Agricultural real property accounts for approximately 1.7% (as of 2010) of the total real property value in the state. While no Agricultural studies are currently planned, they can still be completed on an "as needed" basis when warranted. Additionally, agricultural values are monitored as part of the normal duties of the Local Assistance section, and are also tracked through year end reports supplied by the county which would indicate any significant changes requiring additional investigation and scrutiny.

For the 2009 ratio cycle, commercial studies were scheduled for completion every four years, with approximately half of the counties being completed in each two year ratio cycle. This practice was deemed necessary due to budget and staffing reductions. In making the decision to extend the time frame for measuring commercial assessments in all Missouri counties, particular scrutiny was given to the complexities and nuances of the commercial real estate market. It generally takes longer to recognize trends in commercial real estate due to the timing of leases and the overall scarcity of sales and income information available at any time, and historical information indicated that commercial assessments had far less variability between cycles than the residential subclass.

The State Tax Commission incurred additional budget and staffing reductions. Beginning with the 2015 commercial ratio cycle, seventy-five (75) counties will be completed on a four year ratio cycle with approximately half of the counties being completed in each two year ratio study cycle. Forty (40) counties will be on a six year process with approximately one-third of the counties being completed in each two year ratio study cycle. Counties that are on a six year rotation will be monitored between studies by the Form 11 and 11A, County Index Study, Land Value Studies, Sales Analysis, and 30 commercial parcels to be reviewed by Assessment Representatives/Appraisers in the cycle a commercial ratio is not performed. Additional studies

by the Assessment Representative/Appraisers may be conducted if deemed necessary.

4. STATUTORY ASSESSMENT RATES

Once a property is valued by the county, the property's assessment is calculated. The assessment rates are statutorily set as follows:

Residential property assessments reflect 19% of the property's market value.
Agricultural property assessments reflect 12% of the property's production and/or market value.
Commercial property assessments reflect 32% of the property's market value.

These different assessment rates allocate the burden between the three subclasses of real property.

4.2 RATIO STUDY METHODOLOGY

A brief description of the various ratio studies conducted by the Commission follows. The Commission's studies use both sales and appraisals as proxies of market value. The Commission's Assessment Ratio Study follows the general guidelines and requirements set forth in the *Standard on Ratio Studies* published by the International Association of Assessing Officers.

1. RESIDENTIAL RATIO STUDY

Residential assessments are tested every biennial reassessment (once every two years.) Market value is the basis of value for properties in the residential subclass. There are three types of studies used to determine the level and uniformity of assessment for residential property.

1. Traditional Sales Study – Valid sales representative of the population are used to measure fair market value for comparison to the county's assessed values.
2. Appraisal Study – Approximately 25 properties with a residential assessment are randomly selected and independently appraised for comparison to the county's assessed values.

2. AGRICULTURAL RATIO STUDY

A random, independent Appraisal Study is the only method currently used by the Commission to determine the level of assessment for the agricultural subclass. Prior to the 2007 assessment cycle, Agricultural assessments were tested once every three biennial reassessments (once every six years.) Approximately 35 properties with an agricultural assessment were randomly selected and independently appraised for comparison to the county's assessed values.

Agricultural studies have been suspended since the 2007 assessment cycle. If future agricultural studies are performed, it is likely that the sample size would be between 20 to 30 properties as the STC updated its sample size requirements for appraisal studies in 2009.

3. COMMERCIAL RATIO STUDY

A random, independent Appraisal Study is the only method currently used by the Commission to determine the level of assessment for the commercial subclass. Approximately 30 properties with a commercial assessment are randomly selected and independently appraised for comparison to the county's assessed values.

4.3 DATA REQUIREMENTS

In order to perform ratio study analyses of all 115 assessment jurisdictions, the Commission must collect enough information from the counties to facilitate valid and reliable ratio study results. The first step in the ratio study process is to collect information concerning the real estate properties and their assessed values so that they can be analyzed and measured.

The Commission makes a universal data request that is the same for each assessment jurisdiction for each ratio study cycle. Generally, the Commission asks for the following data sets:

- Assessment roll
- Building Structure database
- Sales database

The Commission requires the requested information be submitted in a computer database format. The objective for this requirement is to make the collection of data as efficient as possible.

These data sets are described in more detail below.

1. ASSESSMENT ROLL

An electronic version of the assessment roll is requested from each county. The information request sent to the county assessor is shown in **Exhibit 4-1.**

Exhibit 4-1
Requested Database Fields ***(2015 cycle example)***

Please include a data dictionary listing of all codes and the definitions that these codes represent for all variables in any database. Please include column headers.

Field Name	**Format**	**Contents**
UPN	Text	Unique Identifier for a parcel or property. The UPN can be masked with decimals and hyphens or just a string of numbers and letters.
RES15	Numeric	The Residential Assessment Value for the 2015 Tax Year
AGR15	Numeric	The Agriculture Assessment Value for the 2015 Tax Year
COM15	Numeric	The Commercial Assessment Value for the 2015 Tax Year
RES14	Numeric	The Residential Assessment Value for the 2014 Tax Year
AGR14	Numeric	The Agriculture Assessment Value for the 2014 Tax Year
COM14	Numeric	The Commercial Assessment Value for the 2014 Tax Year
SITUSADD	Text	Situs Address (If unavailable, do not include mailing address)
SITUSCITY	Text	Situs City (If unavailable, do not include mailing city)
SITUSSTATE	Text	Situs State (If unavailable, do not include mailing state)
SITUSZIP	Text	SitusZip (If unavailable, do not include mailing zip)
LEGAL	Text	Legal Description
LOT	Text	Lot
BLO	Text	Block
SUB	Text	Subdivision
SEC	Text	Section
TWN	Text	Township
RNG	Text	Range
LANDUSE	Text	Land Use such as improved, vacant, etc
SCHOOLDIST	Text	School District Code (Include a coding key file) If school district code is unavailable, include tax code with a coding key.
GEOGRAPHIC	Text	County's Preferred Geographic Stratification Variable. If the school district variable is not a preferred way to segment the county, then a different variable, such as zones or areas, should be included.
ACRES	Text	Acreage

The following fields, shown in **Exhibit 4-2**, are requested with either the assessment roll or the building structure database, if available:

Exhibit 4-2

Please include a data dictionary listing of all codes and the definitions that these codes represent for all variables in any database. Please include column headers.

LOTFRONT	Text	Lot Front Length
LOTDEPTH	Text	Lot Depth Length
ROOMS	Numeric	The number of above grade rooms
BED	Numeric	The number of above grade bedrooms
BATH	Numeric	The number of above grade bathrooms
BSMNTSIZE	Text	Indicate the size of the basement (Sq Ft, full, partial, none, *0,* etc, or other code)
BSMNTFIN	Text	Indicate the finish of basement (None, partial, finished, etc, or other code; include BR/Bath counts if available and not reported above)
GARAGETYPE	Text	Indicate the type of garage (carport, attached, detached, none, etc, or other code)
GARAGECNT	Text	The number of cars for the garage

(If the county cannot delineate bedrooms and bathrooms for above grade vs. below grade, then the total number of bedrooms and bathrooms should be provided)

Requested Database Formats
The Commission prefers assessment roll data in a Microsoft Excel file. If that option is not available, then the preferred method is through a pipe "|" delimited file. Text files with a comma delimiter are acceptable, but there are often issues importing the large databases this way. The Commission also requests any codes used in the school district or geographic stratification variable.

2. BUILDING STRUCTURE DATABASE

A building structure database is requested separately from the assessment roll to avoid confusion on defining a year built or living area for a property that has more than one dominant structure. The State Tax Commission's procedure involves defining improvements that are primary structures. These improvements often include single-family, multi-family, mobile homes, etc. If more than one of these primary structures exists on a parcel, then the information for that one parcel is not included in the year built or living area analysis. For example, a property that sells with two or more primary structures is used in the overall statistics and the geographic location stratification, but not in the year built or improved area stratification.

Exhibit 4-3
Requested Building Structure Database Fields

Please include a data dictionary listing of all codes and the definitions that these codes represent for all variables in any database. Please include column headers.

Field Name	Format	Contents
UPN	Text	Unique Identifier for a parcel or property. The UPN can be masked with decimals and hyphens or just a string of numbers and letters
STRUCTURE	Text	A code that can refer to the type of structure. (Single Family, Duplex, Garage, Utility, etc.)
STYLE	Text	Descriptive Property Features (1 Story, 2 Story, Split Level, etc)
YRBLT	Numeric	The year the structure was built
AREA	Numeric	The size of the property. Gross living area is preferred if available. Otherwise, include base area. Adjusted area is not desired.

For some counties, living area may not be an available field. In such a case, reporting base area is preferred. Adjusted area is not desired.

The building structure information will be filtered to include only dominant structures. Parcels with one dominant structure will have their detail information paired to the assessment roll for analysis.

Requested Database Formats
The Commission prefers building data in a Microsoft Excel file. If that option is not available, then the preferred method is through a pipe "|" delimited file. Text files with a comma delimiter are acceptable, but there are often issues importing the large databases this way. The Commission also requests any codes used in the school district or geographic stratification variable.

3. SALES DATABASE

A sales database is requested from all counties. The sales database deadline for submission is around April 15th of the even numbered year subsequent to the assessment year. The database should consist of sales between January 1 of the even numbered year preceding the assessment year and December 31 of the assessment year (odd numbered year). The minimum fields that should be included are parcel number, sale price, sale date, and validity codes (if applicable). As an example, for the 2015 assessment year, the deadline for submission of the sales database is April 15, 2016. The database will consist of sales between January 1, 2014 and December 31, 2015.

A. Sales Validation and Verification

The Commission generally adheres to the IAAO Standard on Ratio Studies in performing ratio studies for each county. The Commission must be able to verify the county's sales follow IAAO guidelines for validation and verification before sales can be utilized for a sales study. A sales survey is required from each county to verify sales validation and verification procedures.

The STC relies on the following IAAO standards and guidelines concerning the validation and verification of sales (all available at www.iaao.org):

- IAAO Standard on Ratio Studies (Appendix A)
- IAAO Standard on Verification and Adjustment of Sales
- IAAO Guide to Foreclosure-Related Sales and Verification Procedures

Valid Sales

Generally speaking, a valid sale is a transaction that reflects market value where a willing seller offers the property but is not obligated to sell it, and is bought by a person who is willing to purchase but is not forced to do so. A valid sale can also be described as a sale that meets the definition of a market value transaction.

Invalid Sales

Sales Generally Invalid for Ratio Studies (from IAAO publications):

- Sales involving government agencies and public utilities
- Sales involving charitable, religious, or educational institutions
- Sales involving financial institutions
- Sales between relatives or corporate affiliates
- Sales settling an estate
- Forced sales
- Sales of doubtful title

Sales with Special Conditions

The IAAO requires these sales be used with caution and requires substantial verification before being used for ratio studies. DO NOT use these sales unless certain they are valid:

- Trades
- Partial interests
- Land contracts

- Incomplete or unbuilt common property
- Auctions

B. Requested Sales Database Fields

The fields shown in **Exhibit 4-4** are requested for residential sales ratio analysis:

Exhibit 4-4

Please include a data dictionary listing all codes and the definitions that these codes represent for all variables in any database.

Field Name	Format	Contents
UPN	Text	Unique Identifier for a parcel or property. The UPN can be masked with decimals and hyphens or just a string of numbers and letters.
Sale Price	Numeric	Sale Price; the proxy for market value between a willing buyer and a willing seller.
Sale Date	Date (mm/dd/yyyy)	The date of the transaction. The format can include month and year if the exact date is unknown.
Validation	Text	Any validation coding or key that determines if a sale was valid or invalid.

Requested Database Formats

The Commission prefers sales data in a Microsoft Excel file. If that option is not available, then the preferred method is through a pipe "|" delimited file. Text files with a comma delimiter are acceptable, but there are often issues importing the large databases this way.

Additionally, the Commission collects a copy of the county's sales letter used to collect sales information. The Commission also prepares a sales survey that asks the county to explain how they comply with the IAAO guidelines on screening sales; this survey information is collected at the beginning of each ratio study cycle. This information is reviewed to ensure that proper sales screening and validation processes are being followed at the county level.

4. ONLINE DATA PROCESSES

To help counties save on costs, all requested material can be sent electronically through a File Transfer Protocol (FTP.) Links are available on the STC website at http://stc.mo.gov/ and secure accounts are available to county officials.

4.4 DATABASE PREPARATION

1. COUNTY INFORMATION

An Incoming Data folder contains only the information received from the county; the Assessment Roll, the Building Structures database, and the Sales database.

- Assessment Roll – An electronic source that lists every parcel in the county with their descriptive information, as requested in the description above.
- Building Structure Databases – An electronic source that lists every improvement in the county.
- Sales Databases – An electronic source that lists the information collected by the assessor concerning sold properties.
- Codes – Any codes or data dictionaries received from the counties

2. FORMATTING FILES

- The initial step for any file received is to format the file type and Uniform Parcel Number to be legible by any program utilized by the Commission. Additional steps may be needed to process the files since information and formats differ by county. Assessment totals from the received Assessment Roll are verified against the odd numbered year Form 11 and Form 11A to determine the totals per each subclass are accurate.
- Within the Building Structure database, non-residential structure codes, unnecessary fields, and duplicate parcels are removed.
- The formatted Assessment Roll is merged with the Building Structure Database via the Uniform Parcel Number.
- After formatting the Sales Database, the following steps occur:
  - Invalid sales are excluded
  - Resales (properties that sell more than once) are identified.
  - Duplicate sales (repeated records) are removed properly.
  - If a property sells more than one time, then all sale prices must be within 5% of the minimum sale price, and the sale closest to the January 1st assessment date is used, discarding the others. Otherwise, all sales from that property are

removed.
  - New construction sales data is flagged for further analysis.
  - Sale dates are categorized for the different stages of the quality testing.
- The formatted Sales Database is merged with the formatted and consolidated Assessment Roll/Building Structure Database file via the Uniform Parcel Number.

4.5 RANDOM SAMPLING PROCESS

A formatted assessment roll is generated for the residential and commercial subclass. The file is sorted in Uniform Parcel Number order.

If the county identifies tax exempt properties in their database information, then the Commission will remove those parcels prior to sampling. If tax exempt properties are not identified by the county, then those properties will be omitted later in the process when identified by the statistician or the appraiser, but after the sampling procedure.

A random sample for each of the three subclasses is generated. Each property that has an assessment of the subclass being tested has an equal chance of selection. Approximately 25 (residential) or 30 (commercial) randomly selected properties will be appraised by an employee from the State Tax Commission.

1. STRATIFIED RANDOM SAMPLING PROCESS FOR APPRAISAL STUDIES

Based on the assistance and recommendations of the MO Ratio Study Technical Advisory Group, the STC implemented stratified random sampling for appraisal studies in the 2011 cycle. The benefit of stratified random sampling is more stability in the random sampling process, which should benefit the overall ratio study analysis.

The stratification procedure is based on the *assessed value* of the parcel population for both the residential and commercial subclass. The parcel population is stratified into four quartiles as follows:

1st Quartile:	Low to Low/Middle value properties
2nd Quartile:	Low/Middle to Middle value properties
3rd Quartile:	Middle to Middle/High value properties
4th Quartile:	Middle/High to High value properties

The overall sample sizes for appraisal studies is as follows:

- 25 appraisals for residential studies
- 30 appraisals for commercial studies

Since the total number of samples is not divisible by four, for either residential or commercial appraisal studies, there will be slightly different numbers of samples pulled from each stratum (quartile) as shown below:

	1st Quartile # of samples	*2nd Quartile* # of samples	*3rd Quartile* # of samples	*4th Quartile* # of samples	**Total samples**
Residential	**6**	**6**	**7**	**6**	**25**
Commercial	**7**	**8**	**8**	**7**	**30**

Because there is one more sample in some strata than in others, the Commission is purposefully choosing to include more samples in the 2nd and 3rd quartiles (in the middle) rather than the 1st and 4th quartiles (low and high ends).

The result is a completely random selection of samples for the appraisal ratio study. Every parcel within each stratum (quartile), and subsequently every sample in the parcel population, has an equal chance of being selected for the ratio study.

Statistics will only be performed on the total number of samples and there will be no statistical analysis of any of the individual strata (quartiles).

Assessors should not notice any changes in State Tax Commission operations and will have no additional requirements to implement these new sampling procedures.

The following screenshots of fictitious data demonstrate how stratified random sampling is applied.

Exhibit 4-5: Data received from a County:

	A	B	C	D
1	UPN	RES13	AG13	COM13
2	01-03.1-06-00.0-00-01.000	0	350	0
3	01-03.1-06-00.0-00-04.000	0	530	0
4	01-03.1-06-00.0-00-05.000	0	960	0
5	01-03.1-06-00.0-00-06.000	4480	4370	0
6	01-03.1-06-00.0-00-07.000	5420	1660	0
7	01-03.1-06-00.0-00-08.000	0	720	0
8	01-03.1-06-00.0-00-09.000	23280	3920	0
9	01-03.1-06-00.0-00-10.000	22140	100	0
10	01-03.1-06-00.0-00-12.000	4160	5680	0
11	01-03.1-06-00.0-00-13.000	30940	13900	0
12	01-03.1-06-00.0-00-14.000	0	870	0
13	01-03.1-06-00.0-00-15.010	19180	220	0
14	01-03.1-06-00.0-00-16.000	0	840	0
15	01-03.1-06-00.0-00-17.000	0	800	0
16	01-03.1-06-00.0-00-18.000	0	880	0
17	01-03.1-06-00.0-00-19.000	0	410	0
18	01-03.2-07-00.0-00-01.000	0	2660	0
19	01-03.2-07-00.0-00-01.010	0	480	0
20	01-03.2-07-00.0-00-02.000	0	670	0

Exhibit 4-6: Residential Assessment Roll includes all samples with a residential assessed value:

	A	B	C	D
1	UPN	RES13	AG13	COM13
2	01-03.1-06-00.0-00-06.000	4480	4370	0
3	01-03.1-06-00.0-00-07.000	5420	1660	0
4	01-03.1-06-00.0-00-09.000	23280	3920	0
5	01-03.1-06-00.0-00-10.000	22140	100	0
6	01-03.1-06-00.0-00-12.000	4160	5680	0
7	01-03.1-06-00.0-00-13.000	30940	13900	0
8	01-03.1-06-00.0-00-15.010	19180	220	0
9	01-03.2-07-00.0-00-03.000	6120	1730	0
10	01-03.2-07-00.0-00-04.000	36060	5160	0
11	01-03.2-07-00.0-00-05.000	3280	2890	0
12	01-04.0-18-00.0-00-05.000	1240	940	0
13	01-04.0-18-00.0-00-06.000	1240	2380	0
14	01-04.0-18-00.0-00-08.000	10430	3980	0
15	01-04.0-18-00.0-00-08.010	5330	0	0
16	01-04.0-19-00.0-00-03.000	9590	1780	0
17	01-04.0-19-00.0-00-07.000	10710	2190	0
18	01-04.0-19-00.0-00-16.000	1240	3750	0
19	01-09.0-30-00.0-00-01.000	22040	8170	0
20	01-09.0-30-00.0-00-02.000	20200	10400	0

Exhibit 4-7: Using Excel, insert a column for random numbers:

	A	B	C	D	E
1	RandomNumber	UPN	RES13	AG13	COM13
2	3715.94	01-03.1-06-00.0-00-06.000	4480	4370	0
3	3749.57	01-03.1-06-00.0-00-07.000	5420	1660	0
4	4281.89	01-03.1-06-00.0-00-09.000	23280	3920	0
5	2954.32	01-03.1-06-00.0-00-10.000	22140	100	0
6	5687.02	01-03.1-06-00.0-00-12.000	4160	5680	0
7	1470.01	01-03.1-06-00.0-00-13.000	30940	13900	0
8	1611.02	01-03.1-06-00.0-00-15.010	19180	220	0
9	736.59	01-03.2-07-00.0-00-03.000	6120	1730	0
10	587.02	01-03.2-07-00.0-00-04.000	36060	5160	0
11	3474.16	01-03.2-07-00.0-00-05.000	3280	2890	0
12	421.39	01-04.0-18-00.0-00-05.000	1240	940	0
13	1772.06	01-04.0-18-00.0-00-06.000	1240	2380	0
14	117.24	01-04.0-18-00.0-00-08.000	10430	3980	0
15	1144.71	01-04.0-18-00.0-00-08.010	5330	0	0
16	4625.62	01-04.0-19-00.0-00-03.000	9590	1780	0
17	15.92	01-04.0-19-00.0-00-07.000	10710	2190	0
18	5160.17	01-04.0-19-00.0-00-16.000	1240	3750	0
19	1768.2	01-09.0-30-00.0-00-01.000	22040	8170	0
20	3412.53	01-09.0-30-00.0-00-02.000	20200	10400	0

Exhibit 4-8: Add columns before the RandomNumber column, and re-label as needed. The columns needed for the random sampling are, in order: Cnty ID, Sample, Book, Control, UPN, Res13, AGR13, COM13, Name1, Name2, SitusAddress1, SitusAddress2, SitusAddress3, SitusCity, Section, Township, Range, Acres, Lotsize, Legal.

	A	B	C	D	E	F	G	H
1	CntyID	Sample	Book	Control	UPN	RES13	AG13	COM13
2	137			3715.94	01-03.1-06-00.0-00-06.000	4480	4370	0
3	137			3749.57	01-03.1-06-00.0-00-07.000	5420	1660	0
4	137			4281.89	01-03.1-06-00.0-00-09.000	23280	3920	0
5	137			2954.32	01-03.1-06-00.0-00-10.000	22140	100	0
6	137			5687.02	01-03.1-06-00.0-00-12.000	4160	5680	0
7	137			1470.01	01-03.1-06-00.0-00-13.000	30940	13900	0
8	137			1611.02	01-03.1-06-00.0-00-15.010	19180	220	0
9	137			736.59	01-03.2-07-00.0-00-03.000	6120	1730	0
10	137			587.02	01-03.2-07-00.0-00-04.000	36060	5160	0
11	137			3474.16	01-03.2-07-00.0-00-05.000	3280	2890	0
12	137			421.39	01-04.0-18-00.0-00-05.000	1240	940	0
13	137			1772.06	01-04.0-18-00.0-00-06.000	1240	2380	0
14	137			117.24	01-04.0-18-00.0-00-08.000	10430	3980	0
15	137			1144.71	01-04.0-18-00.0-00-08.010	5330	0	0
16	137			4625.62	01-04.0-19-00.0-00-03.000	9590	1780	0
17	137			15.92	01-04.0-19-00.0-00-07.000	10710	2190	0
18	137			5160.17	01-04.0-19-00.0-00-16.000	1240	3750	0
19	137			1768.2	01-09.0-30-00.0-00-01.000	22040	8170	0
20	137			3412.53	01-09.0-30-00.0-00-02.000	20200	10400	0

Exhibit 4-9: Create four tabs at the bottom of the page, TabA, TabB, TabC, and TabD.

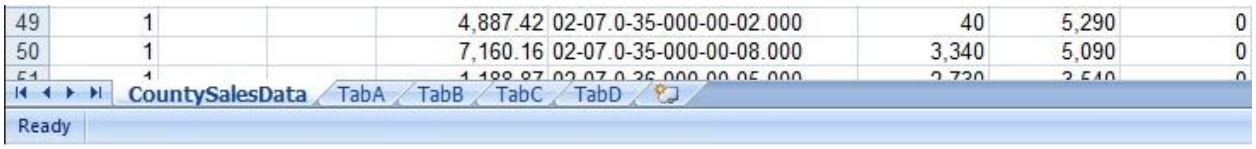


Exhibit 4-10: Sort the data by the RES13 column.

	A	B	C	D	E	F	G	H
1	CntyID	Sample	Book	Control	UPN	RES13	AG13	COM13
2	137			0.33	15-03.0-08-00.0-00-08.000	3650	0	0
3	137			1.43	02-07.0-26-00.0-00-03.030	12000	150	0
4	137			1.47	06-03.0-06-00.0-00-12.010	3430	240	0
5	137			1.84	22-04.1-17-00.0-00-05.000	25250	1680	0
6	137			2.21	14-04.0-20-00.0-00-11.000	5720	2670	0
7	137			3.53	03-08.0-33-00.0-00-09.000	31360	1750	0
8	137			3.65	06-01.0-12-00.0-00-06.000	3620	0	16470
9	137			6.15	11-03.1-06-00.0-00-06.000	11600	1650	12340
10	137			6.17	10-09.0-30-00.0-00-24.000	9970	0	0
11	137			6.66	15-03.0-06-04.2-18-05.000	11060	0	3380
12	137			7.54	03-07.0-26-04.0-02-14.000	2970	0	0
13	137			8.29	10-08.0-27-00.0-00-21.000	9680	100	0
14	137			8.36	18-04.0-19-00.0-00-01.000	12200	1780	0
15	137			8.63	15-03.0-05-02.2-01-01.000	16910	0	0
16	137			11.37	10-01.1-02-00.0-00-21.020	1720	0	0
17	137			11.71	14-03.0-08-00.0-00-22.000	9780	0	0
18	137			12.2	22-04.2-19-00.0-00-06.000	26650	0	0
19	137			13.76	15-03.0-05-02.2-09-01.000	10200	0	0
20	137			14.14	20-09.0-29-00.0-00-05.000	1100	1060	0

Exhibit 4-11: Sort the data by the Control column (formerly the RandomNumber column).

	A	B	C	D	E	F	G	H
1	CntyID	Sample	Book	Control	UPN	RES13	AG13	COM13
2	137			0.33	15-03.0-08-00.0-00-08.000	3650	0	0
3	137			1.43	02-07.0-26-00.0-00-03.030	12000	150	0
4	137			1.47	06-03.0-06-00.0-00-12.010	3430	240	0
5	137			1.84	22-04.1-17-00.0-00-05.000	25250	1680	0
6	137			2.21	14-04.0-20-00.0-00-11.000	5720	2670	0
7	137			3.53	03-08.0-33-00.0-00-09.000	31360	1750	0
8	137			3.65	06-01.0-12-00.0-00-06.000	3620	0	16470
9	137			6.15	11-03.1-06-00.0-00-06.000	11600	1650	12340
10	137			6.17	10-09.0-30-00.0-00-24.000	9970	0	0
11	137			6.66	15-03.0-06-04.2-18-05.000	11060	0	3380
12	137			7.54	03-07.0-26-04.0-02-14.000	2970	0	0
13	137			8.29	10-08.0-27-00.0-00-21.000	9680	100	0
14	137			8.36	18-04.0-19-00.0-00-01.000	12200	1780	0
15	137			8.63	15-03.0-05-02.2-01-01.000	16910	0	0
16	137			11.37	10-01.1-02-00.0-00-21.020	1720	0	0
17	137			11.71	14-03.0-08-00.0-00-22.000	9780	0	0
18	137			12.2	22-04.2-19-00.0-00-06.000	26650	0	0
19	137			13.76	15-03.0-05-02.2-09-01.000	10200	0	0
20	137			14.14	20-09.0-29-00.0-00-05.000	1100	1060	0

Exhibit 4-12: Calculate how many records for each tab. In a Residential Study, Tabs A, B and D will need 6/25 of the total, while Tab C will need 7/25 of the total. (For Commercial studies, tabs A and D would be 8/30 of the total, and tabs B and C would be 7/30 of the total.) In this example, with 9349 sales, tabs A, B and D each have 2244 sales, while tab C has 2618 sales.

9347	1			1,151.53	13-05.0-15-002-01-17.000	249,370	0	0
9348	1			3,959.11	13-02.0-04-1.1-04-14.000	275,510	0	0
9349	1			2,704.01	13-05.0-16-004-01-01.000	306,600	0	0
9350	1			8,555.93	13-03.0-08-001-06-07.000	351,820	0	0
9351						2243.76		
9352						=7/25*9349		

CountySalesData TabA TabB TabC TabD

Edit

Exhibit 4-13: Under the Sample column on each tab, enter the sample number. Tab A will be 1-6, Tab B will be 7-12, Tab C will be 13-19, and Tab D will be 20-25. (Commercial will be 1-7, 1-8, 1-8 and 1-7, respectively.) After the samples, enter the alternate sample IDs, A1-A5 for tab A, B1-B5 for tab B, and so on.

	A	B	C	D	E	F	G	H
1	CntyID	Sample	Book	Control	UPN	RES13	AG13	COM13
2	137	1		0.33	15-03.0-08	3650	0	0
3	137	2		1.43	02-07.0-26	12000	150	0
4	137	3		1.47	06-03.0-06	3430	240	0
5	137	4		1.84	22-04.1-17	25250	1680	0
6	137	5		2.21	14-04.0-20	5720	2670	0
7	137	6		3.53	03-08.0-33	31360	1750	0
8	137	A1		3.65	06-01.0-12	3620	0	16470
9	137	A2		6.15	11-03.1-06	11600	1650	12340
10	137	A3		6.17	10-09.0-30	9970	0	0
11	137	A4		6.66	15-03.0-06	11060	0	3380
12	137	A5		7.54	03-07.0-26	2970	0	0
13	137			8.29	10-08.0-27	9680	100	0
14	137			8.36	18-04.0-19	12200	1780	0
15	137			8.63	15-03.0-05	16910	0	0
16	137			11.37	10-01.1-02	1720	0	0
17	137			11.71	14-03.0-08	9780	0	0
18	137			12.2	22-04.2-19	26650	0	0
19	137			13.76	15-03.0-05	10200	0	0
20	137			14.14	20-09.0-29	1100	1060	0

Exhibit 4-14: Between the samples and the alternates, insert a line and shade it black.

	A	B	C	D	E	F	G	H
1	CntyID	Sample	Book	Control	UPN	RES13	AG13	COM13
2	137	1		0.33	15-03.0-08	3650	0	0
3	137	2		1.43	02-07.0-26	12000	150	0
4	137	3		1.47	06-03.0-06	3430	240	0
5	137	4		1.84	22-04.1-17	25250	1680	0
6	137	5		2.21	14-04.0-20	5720	2670	0
7	137	6		3.53	03-08.0-33	31360	1750	0
8								
9	137	A1		3.65	06-01.0-12	3620	0	16470
10	137	A2		6.15	11-03.1-06	11600	1650	12340
11	137	A3		6.17	10-09.0-30	9970	0	0
12	137	A4		6.66	15-03.0-06	11060	0	3380
13	137	A5		7.54	03-07.0-26	2970	0	0
14	137			8.29	10-08.0-27	9680	100	0
15	137			8.36	18-04.0-19	12200	1780	0
16	137			8.63	15-03.0-05	16910	0	0
17	137			11.37	10-01.1-02	1720	0	0
18	137			11.71	14-03.0-08	9780	0	0
19	137			12.2	22-04.2-19	26650	0	0
20	137			13.76	15-03.0-05	10200	0	0

4.6 RESIDENTIAL SALES STUDY PROCEDURES

In a Traditional Sales Study, the county's values are compared against sales prices of properties that have occurred within specific time frames. Each comparison of the county's value on a particular parcel as compared to the actual sale price results in a ratio. Statistical analyses are then performed on the ratios that occur from all sales within the specified time frame as compared to the county's values. Currently, the Commission only performs sales studies on residential property.

The Commission attempts to perform a Traditional Sales Study in every county for residential property. Appraisals are only attempted when there are insufficient numbers of sales to reach a valid sample size for a sales study and/or the county fails the sales Reliability Test (i.e. the sales are not representative of the county, sales chasing issues may exist, etc.). The Traditional Sales Study is the most effective and efficient method available to the Commission for performing ratio studies of residential property and provides the most meaningful results for county assessors.

One of the challenges of the Traditional Sales Study is that there is no control over how many homes sells in any given county or where the sales are located within any county. Thus, it is not always possible to obtain a sampling of properties that is representative of the overall population when only utilizing sales information. Missouri has had good results with Traditional Sales Studies, but because they cannot be performed in all counties, the Commission has to rely on Appraisal Studies for residential property in some counties.
Another challenge of the Traditional Sales Study is that not all sales are known to the assessor.

Of Missouri's 115 assessment jurisdictions, only four of the jurisdictions have ordinances or rules in place that require the recordation of sales price information on all real estate transactions. For the rest of the jurisdictions in the state, the assessors collect sales data by relying on property owners to voluntarily return sales questionnaires and report the sale price information. The success rate of assessors in obtaining sales information varies from county to county. The more sales that are available, the more likely the county will qualify for a Traditional Sales Study.

Whenever sales are used in ratio studies, the Commission performs a Reliability Test to ensure that the data and sales utilized in a Traditional Sales Study will yield valid and reliable results. If the county data passes the Reliability Test, then the Traditional Sales Study is attempted.

1. RELIABILITY TEST

A Reliability Test is an analysis of the information received from the county to verify if the information will result in valid and reliable results. Once the county is identified, historical information is inputted, including the county's sales disclosure history. A brief explanation is provided concerning both the quality of the sales validation/screening and the source of the databases. Data is imported from the sales databases submitted by the counties. The sales are inspected within a quality control review. If county sales databases meet the State Tax Commission standards, then the sales are analyzed by the Traditional Sales Study.

The Reliability Test contains the following major components:

- County Sales Collection History
    - Total number of transfers
    - Number of sales letters sent as a percent of transfers
    - Sales returned percentage
    - Number of usable sales from transfers
    - Number of useable sales as a percent of transfers
    - Turnover rate as a percentage of total parcels
    - Turnover rate as a percentage of residential parcels
    - Percent of properties unchanged in value for sold vs. unsold properties
    - Overall statistics for specified time frames
        - Jan – June of Even Year
        - July – Dec of Even Year
        - Jan – June of Odd Year
        - July – Dec of Odd Year
        - 1 Year study period vs. 6 months after
    - Percent of change for sold properties vs. neighboring properties
    - Percent change for sold properties vs. all unsold properties
- Past Ratios

- Post-Trim Statistics by 6 month, 12 month and 24 month periods
- Sales Chasing Detection
- New Construction Procedures
- Sales Screening and Matching Process
    - Identifies when any sales are removed because of:
        - Validation Codes
        - Resales
        - Sales that do not match assessment roll parcel database
        - Mixed-use parcels
        - New construction parcels
- Overall Statistics for Sale Properties
- Sales Letter Information
- Representativeness table with stratification by location, year built, and assessed value

For each reassessment cycle, every county must complete a sales questionnaire survey that indicates whether or not the counties are following IAAO guidelines for screening and validating sales. The results of the survey are shown on the Reliability Test and give quick reference to the analyst concerning the counties sales collection procedures.

The last portion of the Reliability Test compares stratifications of the sales and the residential parcel population (excludes mixed use properties) by Location, Age, and Value. This comparison is a test of whether or not the sales are representative of the residential population. This analysis considers all of the sales in the population.

An example of a Reliability Test is shown in **Exhibit 4-15** on the following pages:

Exhibit 4-15

State Tax Commission of Missouri

Residential Sales Study ◊ 137 - XYZ County ◊ Reliability Test

2013 Reassessment 1/7/2016

Disclaimer This document is only intended for the internal use of the State Tax Commission Ratio Department. It is not intended for distribution outside of the State Tax Commission.

1	Total Res including Mixed Use	5615	Percent	Formula
2	Total Res with no Mixed Use	3955	70.44%	Row 2 / 1
3	Improved Residential Parcels	2478	62.65%	Row 3 / 2
4	Vacant Residential Parcels	1477	37.35%	Row 4 / 2

Row	County Sales Collection		2008	2009	2010	2011	2012
5	Transfers		643	612	579	641	591
6	Sales Letter Sent		171	178	189	212	172
7	Letters Sent to Transfers as %	Rows 6 / 5	26.6%	29.1%	32.6%	33.1%	29.1%
8	Sales Letters Returned		62	63	73	65	53
9	Sales Returned Percent	Rows 8 / 6	36.3%	35.4%	38.6%	30.7%	30.8%
10	Usable Sales		22	15	27	34	20
11	Usable Sales/Transfers %	Rows 10 / 5	3.4%	2.5%	4.7%	5.3%	3.4%
12	Parcel Count		8,474	8,470	8,470	8,557	8,577
13	Transfers Turnover Rate as %	Rows 5 / 12	7.6%	7.2%	6.8%	7.5%	6.9%
14	Usable Sales/Parcel Count %	Rows 10 / 12	0.3%	0.2%	0.3%	0.4%	0.2%

Past Ratios	2003 Appraisal	2005 Appraisal	2007 Appraisal	2009 Appraisal	2011 Sales
Median	20.0%	20.5%	21.9%	18.9%	18.3%
Weighted Mean	18.9%	18.6%	16.2%	17.3%	17.3%
Coefficient of Dispersion	27.0%	54.4%	60.5%	86.8%	29.6%
Price Related Differential	113.8%	143.9%	180.0%	191.0%	117.6%

	Post-Trim Statistics	Count	Median	Weighted Median	Weighted Mean	Mean	COD	PRD
36	Prior to January 2012	6	114.09%	141.1%	193.1%	143.2%	44.6%	143.6%
6 months	January 2012 - June 2012	15	94.98%	96.7%	339.4%	216.8%	146.0%	234.7%
	July 2012 - December 2012	15	102.15%	103.8%	185.0%	137.3%	52.2%	145.9%
	January 2013 - June 2013	13	91.95%	95.4%	114.7%	100.8%	17.0%	103.6%
	July 2013 - December 2013	11	91.95%	92.3%	108.7%	91.6%	20.2%	113.4%
12	January 2012 - Dec. 2012	28	98.13%	98.1%	255.6%	174.6%	96.6%	187.4%
	January 2013 - Dec. 2013	22	92.25%	92.3%	113.7%	97.4%	19.6%	108.0%
24	January 2012 - Dec. 2013	54	94.21%	94.2%	162.0%	120.6%	42.9%	132.4%

	Sales Chasing Detection	Sold Properties	Neighboring Properties	All Unsold Property	Residential Property
2012 - 2013	Number of Parcels	41	51	3,914	3,955
	Median % Change	0.0%	0.0%	0.0%	0.0%
	Percent Changed	26.8% (11)	41.2% (21)	34.3% (1344)	34.3% (1355)
	Neighboring Properties are those within a close proximity to the Sold Properties.				

2013	Assessment Cycle Year

Explanation of Page 1 Reliability

Rows 1 - 4 An analysis to determine if the residential subclass number of assessments are representative of the population.

Row 1	Number of Residential assessments in the county. This number represents the total of residential only assessments plus mixed-use residential assessments.
Row 2	Number of Residential-only assessments in the county. Mixed-use residential assessments have been removed from the study.
Row 3	The number/percentage of assessments in row 2 that are identified as improved by the county's assessment roll.
Row 4	The number/percentage of assessments in row 2 that are identified as vacant by the county's assessment roll.

Rows 5 - 14 An analysis to determine if the sales data is reliable.

Row 5	The number of county transfers recorded by the Technical Assistance staff.
Row 6	The number of county sales letters mailed as recorded by the Technical Assistance staff.
Row 7	The mathematical results of dividing Row 6 by Row 5, a percentage of sales letters mailed to county transfers.
Row 8	The number of county sales letters returned as recorded by the Technical Assistance staff.
Row 9	The mathematical results of Row 8 divided by Row 6. This is the percentage of returned sales letters out of the sales letters mailed by the county. There is no set guideline, but a return of 25% or greater is considered good. A return of 25% or less is considered not so good.
Row 10	The number of sales the county considered to be valid sale as recorded by the Technical Assistance staff. This row of figures shows the amount of market activity. If the numbers are falling off, there is less market activity. If the number are increasing, there is more market activity.
Row 11	The mathematical results of Row 10 divided by Row 5, comparing usable sales to the number of transfers.
Row 12	The county's parcel count verified by the Technical Assistance Staff. The parcel count includes mapped parcels, non-mapped parcels, and personal property accounts. The parcel count could eventually become the county's certified parcel count.
Row 13	The mathematical results of Row 5 divided by Row 12 and a comparison of the transfers to the parcel count. There is no guideline, but depending on the county size it could be around 10%.
Row 14	The mathematical results of Row 10 divided by Row 12, comparing Usable Sales to the Parcel Count. The percentage helps to determine if the number of Usable Sales is representative. In COV Counties, an expected percent would be 2-5%. In large urbanized First Class Counties, an expected percent would be +-1%. In small 3rd Class Counties, an expected percent would be .5-1%.

Past Ratios provide a Historical Reference and indicate if the ratio was a Sales, Hybrid, or Appraisal Study.

Post-Trim Statistics and Sales Chasing Detection are the analyses to determine Ratio's recommendation to proceed with a County Sales or Appraisal Study. Additional information may be provided by the commission or other departments in arriving at a conclusion.

Residential Sales Study ◊ 137 - XYZ County ◊ Reliability Test

2013 Reassessment

Page 2

Removals

☑ Year Built ≥ 2012	☐ County Flag	☑ New Construction	☐ Occupancy

		Sale Count
1	County Submitted	61
2	County Validated	61
3	Duplicate Sales	1

		1 Year	2 Years
4	Sales Matched to Assessment Roll	28	60
5	Residential Only Sales	26	50
6	New Construction	0	0
7	Final Count (Row 5 - 6)	26	50
8	Usable Sales Rate (Row 7 / 1)	42.6%	82.0%
9	Sales with Location	26	50
10	Sales with Improvements	25	45
11	Sales with Year Built	25	42

Overall Statistics	Change	No Change
Sample Size	18	36
Median	107.6%	92.3%
Weighted Mean	89.2%	91.7%
Mean	120.0%	120.9%
Coefficient of Dispersion (COD)	36.3%	43.2%
Price Related Differential (PRD)	134.6%	131.9%

SALES LETTER

Actual Sales Letter • Source of Data • Sales Letters - Screening & Validation

Sales Letter Questions

☐ Sales Date ☑ Reflects Market
☑ Sales Price ☐ Property Type
☑ Personal Property

New Construction Flags

☐ Jan 1 Imp. ☑ Occupancy
☑ Year Built ☐ Other

Source of Data

☑ Sales Letters ☐ Phone Calls
☐ Interviews ☐ Door Hangers
☑ Third Party Source

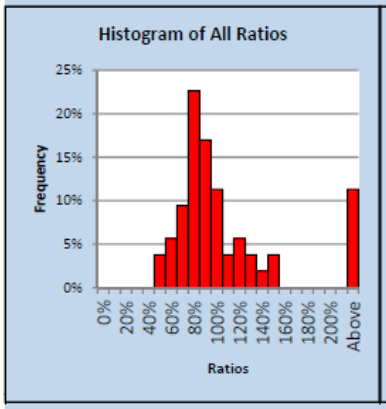
No. of Attempts: 1

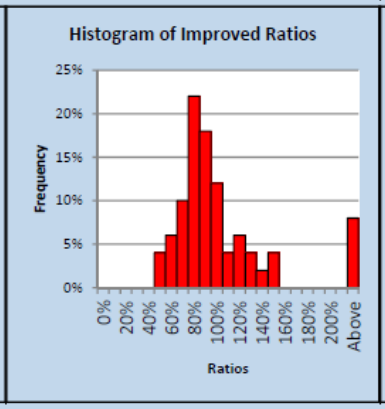
Adjustments

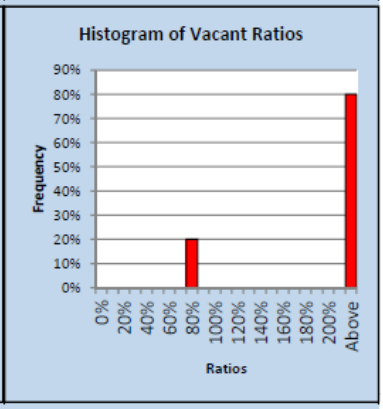
☐ Time Trending ☐ Finance
☑ Pers. Property ☐ Realtor Fees
☐ Other

v=valid i=invalid f=follow up

(i) Foreclosures
(i) Relatives
(i) Trade
(i) Multiparcel
(v) Split
(f) Low Ratio
(v) Short Time
(v) Long Time
(v) Online
(i) Tax Exempt
(i) New Construction Occupancy
(i) Judicial Order
(i) Auction
(v) Estate
(i) Doubtful Title
(f) Resales







Explanation of Page 2 Reliability Study

Row 1	The number of sales submitted by the county to the State Tax Commission. Sale transactions occurred from 1-1-2012 to 12-31-2013.
Row 2	The number of sales the county identified as valid and non-exempt sales.
Row 3	The number of duplicate parcels that were listed in the sales database submitted by the county.

In Rows 4 - 11, sales are analyzed in 1 Year of sales occurring from July 1, 2012 to June 30, 2013 or by 2 Years of sales occurring from January 1, 2012 to December 31, 2013.

Row 4	The number of sales that contained matched parcel numbers in the Sales Database and the County's Assessment Roll. Duplicate sales from Row 3 have been removed.
Row 5	The number of submitted sales having residential assessment only. Mixed-use residential sales have been removed.
Row 6	The number of sales that were identified as having new construction or had a partial assessment. Sales that have a substantial assessment difference in the two-year cycle could indicate new construction or occupancy. Sales that have a Year Built of the current assessment year are also considered to be new construction.
Row 7	The mathematical results of Row 5 minus Row 6. This is the number of residential usable sales in the 6 or 12 months before or after 1-1-2013 after removing new construction or occupancy parcels.
Row 8	The mathematical results of Row 7 divided by Row 1. It is the percentage of Usable Sales as compared to the number of county sales submitted.
Row 9	The number of final sales in Row 7 listed with a school district or some location identifier. The school district is the default . Counties may request another location such as lake lots, tier 1 lots, etc.
Row 10	The number of final sales in Row 7 that were designated as an Improved Sales.
Row 11	The number of final sales in Row 7 with Year Built information.

Overall Statistics compares the statistical measurements (Median, COD, etc.) between those sold parcels that have changed in value between the two years in the cycle to those that have not. Minimal differences between the columns are ideal. Higher disparity between the columns could indicate concerns.

The Sales Letter section analyzes whether a county is complying with IAAO Sales Verification Procedures.

Histograms provide a visual interpretation of various ratios.

Residential Sales Study ◊ 137 - XYZ County ◊ Reliability Test

Reassessment Page 3

	A	B	C	D	E	F	G	H	I
Total Population Location Stratification									
Location	Count			Median Age				Median Value	
	Sales	Res	%	Sales	%	Res	%	Sales	Res
Overall	56	3,955	1.4%	1969	86%	1955	52%	$10,950	$2,520
2	2	277	0.7%	1946	100%	1921	65%	$5,455	$1,640
3	23	1,008	2.3%	1964	96%	1955	82%	$11,610	$8,440
4	1	21	4.8%	2000	100%	1980	81%	$13,190	$8,270
5	4	120	3.3%	2000	100%	1999	88%	$23,985	$14,710
6	2	152	1.3%	1943	100%	1930	71%	$3,635	$3,640
7		50				1979	62%		$3,915
8	13	1,654	0.8%	2001	46%	1960	16%	$7,260	$370
9	10	470	2.1%	1940	100%	1930	87%	$8,525	$5,490
10	1	145	0.7%	1984	100%	1925	70%	$12,950	$2,220
11		58				2000	50%		$7,615

1% of pop.	6 Mos.	7 Mos.	8 Mos.	9 Mos.	10 Mos.	11 Mos.	12 Mos.
40	26	31	38	43	47	47	50

Prior to 12 months, if needed

25 Mos.	26 Mos.	27 Mos.	28 Mos.	29 Mos.	30 Mos.
53	56	56	56	56	56

31 Mos.	32 Mos.	33 Mos.	34 Mos.	35 Mos.	36 Mos.
56	56	56	56	56	56

37 Mos.	38 Mos.	39 Mos.	40 Mos.	41 Mos.	42 Mos.
56	56	56	56	56	56

43 Mos.	44 Mos.	45 Mos.	46 Mos.	47 Mos.	48 Mos.
56	56	56	56	56	56

49 Mos.	50 Mos.	51 Mos.	52 Mos.	53 Mos.	54 Mos.
56	56	56	56	56	56

55 Mos.	56 Mos.	57 Mos.	58 Mos.	59 Mos.	60 Mos.
56	56	56	56	56	56

Explanation of Page 3 columns

The Total Population Location Stratification is an analysis to determine if the sales are representative of the county.

Column A	The number of usable sales after removing new construction or occupancy assessments. This number should match page 2 row 7.
Column B	The number of parcels that have residential assessments only with a school district or some form of location identifier.
Column C	The mathematical results of dividing columns A by B, showing the percentage of sales in each location. There is no scientific method to determine if a location has adequate representation, but based on past studies, the percentage is generally not more than double or less than half of the overall percentage. Locations with low parcel count and sales can vary outside of this guideline.
Column D	The Median Age of Sales listed in Column A. Only parcels with Year Built information are used to find this median.
Column E	The percentage of sales that have a Year Built listed.
Column F	The Median Age of Residental Parcels listed in Column B. Only parcels with Year Built information are used to find this median.
Column G	The percentage of Residential Parcels that have a Year Built listed.
Column H	The Median Value of sales listed in Column A.
Column I	The Median Value of Residential Parcels in Column B.

1% of Population	The mathematical calculation indicating 1% of the Total Res with no Mixed-Use on Page 1 Row 2. This could vary by 1 due to rounding.
6 Mos.	The number of parcels sold in the 6 months (July 1, 2012 to June 30, 2013) before and after the assessment date.
7 Mos.	The number of parcels sold in the 7 months (June 1, 2012 to July 31, 2013) before and after the assessment date.
8 Mos.	The number of parcels sold in the 8 months (May 1, 2012 to August 31, 2013) before and after the assessment date.
9 Mos.	The number of parcels sold in the 9 months(April 1, 2012 to September 30, 2013) before and after the assessment date.
10 Mos.	The number of parcels sold in the 10 months (March 1, 2012 to October 31, 2013) before and after the assessment date.
11 Mos.	The number of parcels sold in the 11 months (February 1, 2012 to November 30, 2013) before and after the assessment date.
12 Mos.	The number of parcels sold in the 12 months (January 1, 2012 to December 31, 2013) before and after the assessment date.

2. TRADITIONAL SALES STUDY REPORT

Once a county passes the Reliability Test, the sales are imported into program templates to calculate the statistics used in the ratio study. The Traditional Sales Study has three stages: Preliminary, Tentative, and Final. First, the data is imported in the Preliminary stage. The statistics calculated are reviewed internally and the report quality is monitored. The internal review consists of both specific computer program functions to review for potential errors, as well as oversight and review of results by Management. A review is also completed by the research analyst when preparing the data and compiling the reports.

The Traditional Sales Study Report can vary in length, but typically includes the following components:

- Cover Page
  - Includes most of the statistical results used in the decision model process
- Overall Weighted Statistics
  - Shows the trimming process and provides a short description of each statistic used in the report.
- Stratification by Vacant and Improved property
  - Includes histograms (graphs) for each stratification
- Stratification by Assessed Value
  - Includes histograms (graphs) for each stratification
- Stratification by Year Built
  - Includes histograms (graphs) for each stratification
- Stratification by Location
  - Includes histograms (graphs) for each stratification
  - Includes overall weighted statistics which are used in the decision model

The Commission attempts to stratify the data into quartiles whenever the data is sufficient and normally limits the number of stratifications between two and four; as an exception, those counties with more than four school districts will possibly have more than four strata for the location variable.

Once it is determined that the sale price estimators are valid, reliable, and reflect the county's level of assessment, the report becomes tentative and is then provided to the county. Data is provided concerning the steps of the sales study process. Counties are encouraged to review the information, ask any questions, and/or provide feedback. Approximately thirty days are allowed for the county to review the report and request a meeting. After meeting with the county to discuss the study results, or after the time period has lapsed, the study becomes final.

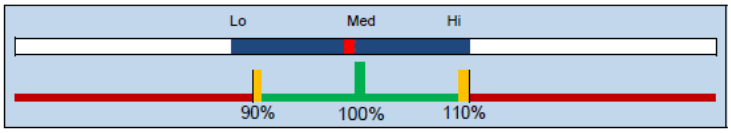
An example of a Traditional Sales Study Report is shown in **Exhibit 4-16**, on the pages which follow:

Exhibit 4-16

State Tax Commission of Missouri

Residential ◊ (Weighted Sales Study) ◊ 2013 Reassessment

XYZ County



State Tax Commission of Missouri
301 West High Street
PO Box 146
Jefferson City, MO 65102-0146

Phone: (573) 751-2414

Fax: (573) 751-1341

Two ratio study procedures are available for analysis:

1) Traditional Sales Study
A sales study that analyzes assessment levels based on sales stratified by land use, location, and characteristics of property.

The Decision Model Statistics listed on this page are overall weighted mathematical calculations based on the data submitted from the county and weighted by both time and location.

2) Random Appraisals

For many jurisdictions, the availability of sales is scarce. In such scenarios, parcels will be randomly appraised. Every parcel will have an equal chance to be selected in the random appraisal study.

http://www.stc.mo.gov/

Decision Model Statistics	@19%	@100%
Weighted Median Ratio	**18.74%**	**98.62%**
95% Low Confidence Interval	16.63%	87.52%
95% High Confidence Interval	20.85%	109.72%
Weighted Coefficient of Dispersion (COD)		**52.56%**

Additional Statistics	@19%	@100%
Mean Ratio	24.99%	131.51%
Weighted Mean Ratio	26.52%	139.57%
Price Related Differential		94.22%

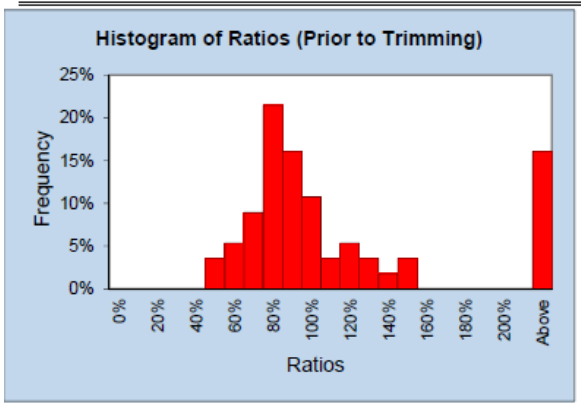
Sample Data	
Pre-Trim Sample Size	56
Low Trims	0
High Trims	2
Post-Trim Sample Size	54
Number of Assessments	3955

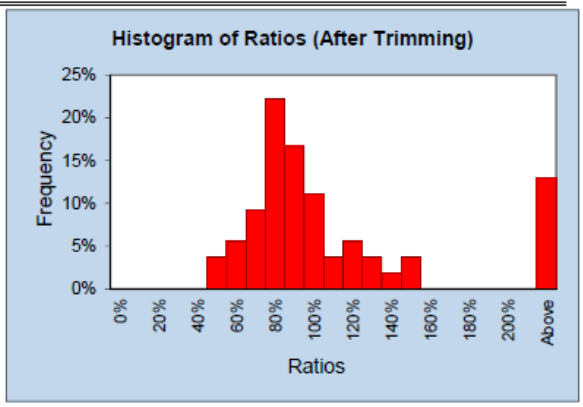
(Time Weighted Sales Study) **Summary Statistics** 2013 Reassessment Page 2

Overall Descriptive Statistics

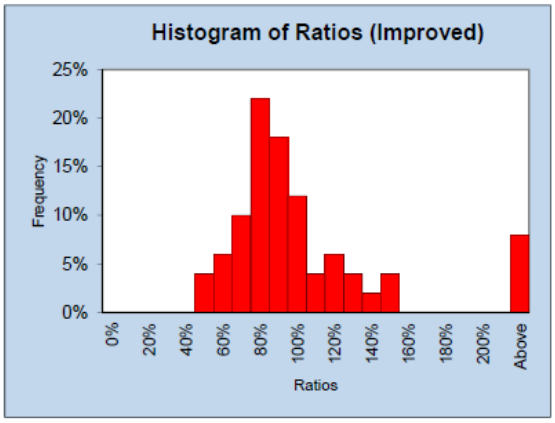
	Pre-Trim	Post-Trim	Description	Required
Sample Size	**56**	**54**	The number of sales in a 26 month period	Minimum 50
Median	**96.46%**	**94.21%**	The middle ratio when ratios are arranged in ascending order.	90%-110%
95% - Low Ratio	*88.93%*	*88.51%*	*The range where the population median most likely exists*	*Overlaps with 90%-110%*
95% - High Ratio	*109.72%*	*106.28%*		
Weighted Mean	**139.64%**	**119.78%**	An average in which ratios are weighted in proportion to their sold amounts.	90%-110%
95% - Low Ratio	*3.03%*	*106.76%*	*The range where the population weighted mean most likely exists*	*Overlaps with 90%-110%*
95% - High Ratio	*276.25%*	*132.80%*		
Mean	**140.87%**	**120.58%**	The arithmetic average of ratios	90%-110%
95% - Low Ratio	*106.49%*	*100.80%*	*The range where the population mean most likely exists*	*Overlaps with 90%-110%*
95% - High Ratio	*175.25%*	*140.35%*		
Coefficient of Dispersion	**41.87%**	**42.87%**	The average percent deviation from the median ratio	Less than 20%
Price Related Differential	100.88%	100.66%	A gauge of assessment uniformity for high and low valued properties	98%-103%

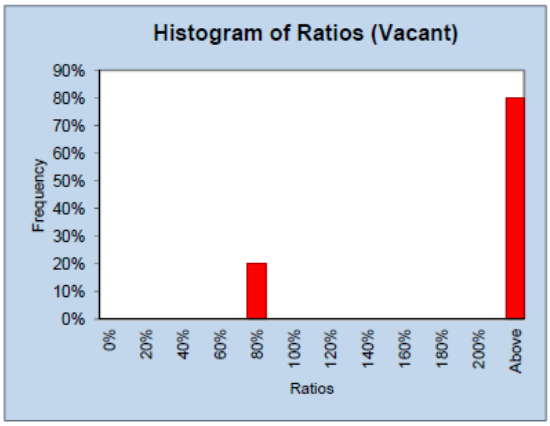
Following Section 5.2 and Appendix B of the IAAO Standard on Ratio Studies, the STC employs outlier trimming guidelines to detect extreme outliers that might otherwise skew statistical results. The STC uses a uniform trimming process that tends to remove as many high outliers as low outliers, thus keeping the median relatively stable.





XYZ (Final-26 months) Improved & Vacant 2013 Reassessment Page 3





Overall Descriptive Statistics

Post Trim	Improved	Vacant	Description	Required
Sample Size	**50**	**5**	The number of sales in a 26 month period	25 minimum
Median	**93.00%**	**382.89%**	The middle ratio when ratios are arranged in ascending order.	90%-110%
95% - Low Ratio	*86.65%*		*The range where the population median most likely exists*	*Overlaps with 90%-110%*
95% - High Ratio	*105.54%*			
Weighted Mean	**107.95%**	**360.40%**	An average in which ratios are weighted in proportion to their sold amounts.	90%-110%
95% - Low Ratio	*98.39%*		*The range where the population weighted mean most likely exists*	*Overlaps with 90%-110%*
95% - High Ratio	*117.51%*			
Mean	**108.63%**	**364.07%**	The arithmetic average of ratios	90%-110%
95% - Low Ratio	*94.84%*		*The range where the population mean most likely exists*	*Overlaps with 90%-110%*
95% - High Ratio	*122.42%*			
Coefficient of Dispersion	**31.47%**	**45.12%**	The average percent deviation from the median ratio	Less than 20%
95% - Low Ratio	*21.64%*		*The range where the population coefficient of dispersion most likely exists*	*95% Low Ratio less than 20%*
95% - High Ratio	*45.36%*			
Price Related Differential	**100.63%**	**101.02%**	A gauge of assessment uniformity for high and low valued properties	98%-103%

XYZ (Final-26 Months) **Stratification by Assessed Value** Page 4

2013 Reassessment

Assessed Value	$190- $10949	$10950- $52280
Sample Size	28	28
High Trims	0	0
Low Trims	0	0
Total Trimmed	0	0
Remaining	28	28
Population	2,805	712
Proportion	79.76%	20.24%

Post Trim Statistics	$190- $10949	$10950- $52280
Sample Size	**28**	**28**
Median	**124.6%**	**89.4%**
Low 95% Conf Int	*97.9%*	*83.5%*
High 95% Conf Int	*211.6%*	*95.0%*
Mean	**190.8%**	**90.9%**
Low 95% Conf Int	*125.9%*	*83.4%*
High 95% Conf Int	*255.7%*	*98.5%*
Weighted Mean	**189.6%**	**91.1%**
Low 95% Conf Int	*135.0%*	*83.7%*
High 95% Conf Int	*244.2%*	*98.4%*
Coefficient of Dispersion	**79.7%**	**15.3%**
Low 95% Conf Int	*54.2%*	*11.0%*
High 95% Conf Int	*128.6%*	*23.2%*
Price Related Differential	**100.6%**	**99.9%**

Statistical results for each stratum are provided for informational purposes only. The STC does not employ a sample size estimator for each individual stratum and cannot validate the individual stratum results with statistical certainty. The information is being provided in that it might assist the user in identifying areas for further study and analysis. Readers are cautioned to disregard statistics for individual strata with pre-trim sample sizes of 25 or less.

XYZ (Final-26 Months) Stratification by Assessed Value Page 5

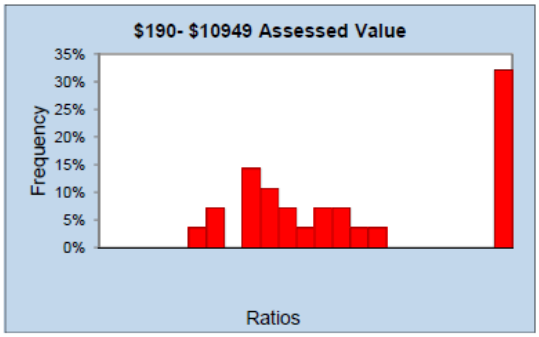
2013 Reassessment

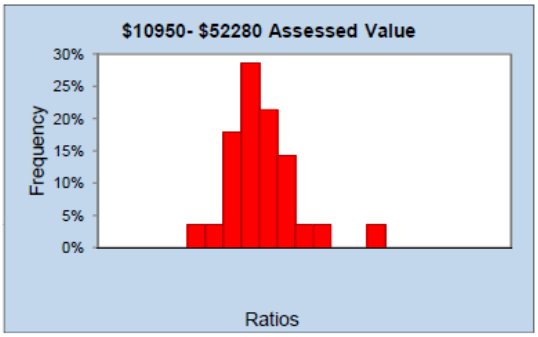
Sales Ratio Histograms by Stratum

Section 3.3 of the IAAO Standard on Ratio Studies recommends stratification to facilitate a more complete and detailed picture of appraisal performance and to enhance sample representativeness.

The STC defaults to stratification into quartiles whenever there is sufficient information available. Depending on the available data, the STC may range from two to eight stratifications, however the STC will avoid over-stratification.

It should be noted that the lowest value stratification(s) may include vacant land which can skew those results.





XYZ (Final-26 months) **Stratification by Year Built** Page 6

2013 Reassessment

Year Built	1880-1968	1969-2012
Sample Size	24	24
High Trims	0	1
Low Trims	0	0
Total Trimmed	0	1
Remaining	24	23
Population	1,314	762
Proportion	63.29%	36.71%

Post Trim Statistics	1880-1968	1969-2012
Sample Size	**24**	**23**
Median	**95.9%**	**92.3%**
Low 95% Conf Int	*75.1%*	*86.7%*
High 95% Conf Int	*125.3%*	*106.3%*
Mean	**110.1%**	**102.5%**
Low 95% Conf Int	*86.6%*	*89.7%*
High 95% Conf Int	*133.6%*	*115.3%*
Weighted Mean	**108.3%**	**102.6%**
Low 95% Conf Int	*89.9%*	*92.6%*
High 95% Conf Int	*126.7%*	*112.6%*
Coefficient of Dispersion	**37.5%**	**18.8%**
Low 95% Conf Int	*24.4%*	*10.2%*
High 95% Conf Int	*61.4%*	*34.0%*
Price Related Differential	**101.6%**	**99.9%**

Statistical results for each stratum are provided for informational purposes only. The STC does not employ a sample size estimator for each individual stratum and cannot validate the individual stratum results with statistical certainty. The information is being provided in that it might assist the user in identifying areas for further study and analysis. Readers are cautioned to disregard statistics for individual strata with pre-trim sample sizes of 25 or less.

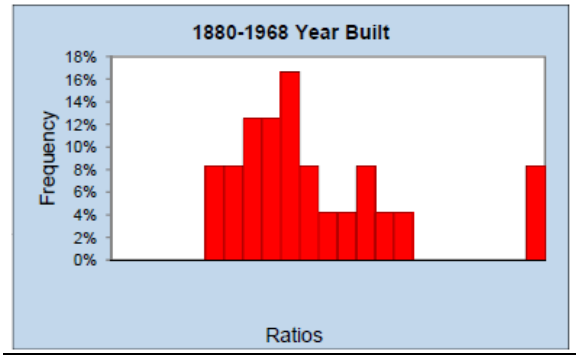
XYZ (Final-26 months) Stratification by Year Built Page 7

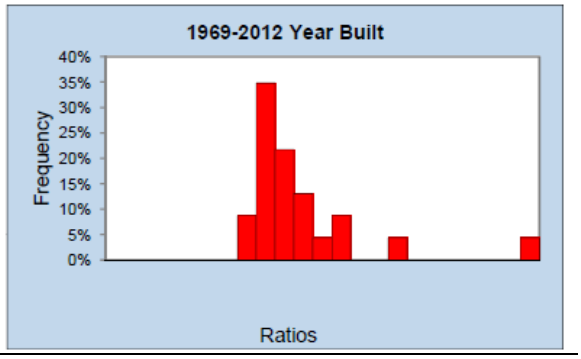
2013 Reassessment

Sales Ratio Histograms by Stratum

Section 3.3 of the IAAO Standard on Ratio Studies recommends stratification to facilitate a more complete and detailed picture of appraisal performance and to enhance sample representativeness.

The STC defaults to stratification into quartiles whenever there is sufficient information available. Depending on the available data, the STC may range from two to eight stratifications, however the STC will avoid over-stratification.





XYZ (Final-26 months) **Stratification by School District** Page 8

2013 Reassessment

School District	Hogwarts	All Others
Sample Size	23	33
High Trims	0	2
Low Trims	0	0
Total Trimmed	0	2
Remaining	23	31
Population	1,008	2,947
Proportion	25.49%	74.51%

Post Trim Statistics	Hogwarts	All Others	Overall Weighted
Sample Size	23	31	54
Median	90.7%	105.5%	98.6%
Low 95% Conf Int	*80.2%*	*89.9%*	*88.5%*
High 95% Conf Int	*98.9%*	*123.9%*	*109.7%*
Mean	108.8%	129.3%	
Low 95% Conf Int	*85.6%*	*98.7%*	
High 95% Conf Int	*132.0%*	*159.9%*	
Weighted Mean	108.9%	128.0%	
Low 95% Conf Int	*90.4%*	*109.7%*	
High 95% Conf Int	*127.5%*	*146.3%*	
Coefficient of Dispersion	36.1%	42.5%	62.8%
Low 95% Conf Int	*21.7%*	*26.9%*	*39.1%*
High 95% Conf Int	*65.9%*	*79.2%*	*107.3%*
Price Related Differential	99.9%	101.0%	

Statistical results for each stratum are provided for informational purposes only. The STC does not employ a sample size estimator for each individual stratum and cannot validate the individual stratum results with statistical certainty. The information is being provided in that it might assist the user in identifying areas for further study and analysis. Readers are cautioned to disregard statistics for individual strata with pre-trim sample sizes of 25 or less.

XYZ (Final-26 months) Stratification by School District Page 9

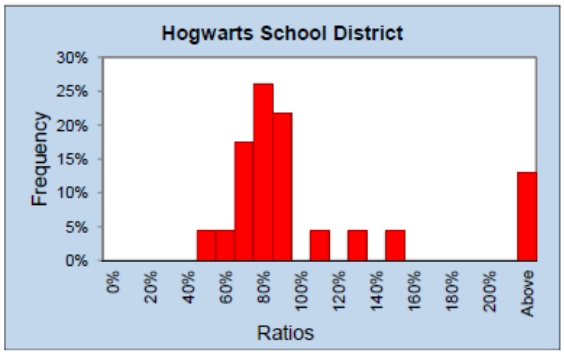
2013 Reassessment

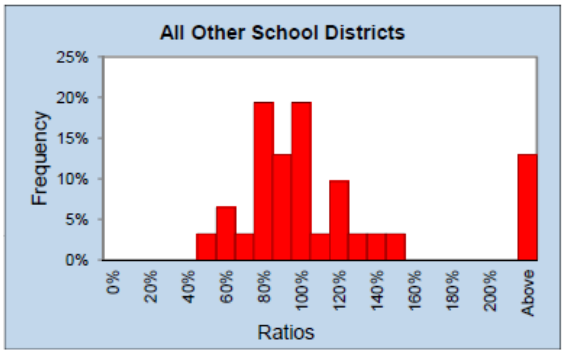
Sales Ratio Histograms by Stratum

Section 3.3 of the IAAO Standard on Ratio Studies recommends stratification to facilitate a more complete and detailed picture of appraisal performance and to enhance sample representativeness.

The default location variable is School District. County assessors can request a different variable other than School District prior to statistical analysis provided it would result in better representation of property characteristics and market tendencies.

When the overall descriptive statistics are out of compliance with STC requirements, weighted statistics are calculated using the proportions of the number of properties in the county amongst each school district strata. When the overall descriptive statistics are out of compliance, school districts with insufficient sales are combined. If the combined sales in locations with insufficient sales are equal to or greater than 25% of the residential population, then the Progressive Hybrid study is performed. If the combined sales in locations with insufficient sales are less than 25% of the residential population, then the Traditional Sales Study is performed, but with the results weighted by location.





3. COUNTY MEETING PROCESS – Residential Sales Study

At the county meeting process, the assessor and staff have already been provided all the information used to generate the Traditional Sales Study, but now have an ability to ask any questions about the data, processes and procedures, or the statistical results. One of the important parts of the meeting process is to verify with the county that only valid and verified sales have been used in the sales study. Other common issues normally discussed deal with extreme outlier ratios; for example, it is important to verify that a vacant land sale is not being compared against an improved property value or vice versa. Even though the sales being used in the Traditional Sales Study have been provided by the county, the tentative results can indicate data entry errors, or other problems that can affect the study results.

Often the county will follow up on sale parcels that are discussed and then will provide the Commission with explanations and documentation concerning each sale in question. The Commission uses the county's additional information to make determinations whether the sale parcels in question should remain in the study or if they may need to be removed. After all the information from the county meeting process is analyzed, the Commission then determines a final ratio study result.

4.7 RANDOM APPRAISAL STUDY

(Residential, Agricultural, and Commercial)
Agricultural and commercial properties are only analyzed by appraisal studies whereas residential property can be analyzed by either sales or appraisals. Sales studies for the agricultural and commercial subclasses are less likely to result in justifiable assessment level estimates.

For the residential subclass, if the Reliability Test from the Traditional Sales Study shows that the sales data is not representative or does not pass the Reliability Test for any other reason, then the Commission will utilize a random appraisal study to determine the level of assessment. In a random appraisal study, the Commission takes a random sample of all of the residential parcels in the county and then sends staff appraisers to appraise those properties that were randomly selected. Currently, the Commission uses 25 random samples for a residential study. The resulting appraised values are used as proxies for market value and compared to the county's value to determine the ratios used in the ratio study.

Agricultural studies rely mainly on the productivity value of the land, rather than market value. Market value sales do not reflect productivity values based on the grading required by the State Tax Commission. No comparison can be made between productivity values determined by the assessor and market values from sales. Due to the different definitions of value being measured

(productivity value vs. market value), no valid, reasonable, or reliable conclusions can be drawn from a sales ratio study on agricultural property. Assessors do use market value sales for analyses on those agricultural properties where market value determinations are required, but this is such a small minority of the agricultural parcels that it still renders an overall sales ratio study to be inadequate for this classification of property.

The inherent disadvantages that can exist in sales are more common in commercial property. The number of sales and/or turnover rate is often inadequate to meet the standards of the State Tax Commission. For commercial property sales, there is immense difficulty separating out intangible value, personal property, and other valuable assets or considerations to obtain an adjusted sale value that appropriately represents the real property value. Additionally, it is much more difficult, subjective and burdensome to accurately validate sales for these properties. Therefore, a random independent appraisal study is utilized to produce valid statistical results that can accurately determine the level of assessment for commercial properties.

A stratified random sample is taken from the subclass population to determine which properties will be appraised.

1. APPRAISAL VALUATION

In the valuation phase, it is the responsibility of the appraiser to research the marketplace and to seek the market information necessary to arrive at the market value of the properties being appraised. This does not apply, however, in the valuation of agricultural and horticultural land when such lands are valued by their productive capability. The effective date of all appraisals completed during the two-year period is January 1 of the reassessment year, or odd-numbered year, being studied. This conforms to the same effective date of appraisal that is used by the assessor in establishing the assessed values on the parcels selected. The Commission has adopted the Uniform Standards of Professional Appraisal Practice (USPAP) as the standard to which appraisals performed for the State Tax Commission must comply, following the recommendations in the *IAAO Standard on Ratio Studies*.

The appraisals performed by ratio staff appraisers employ one or more of the following approaches to value:

- Cost Approach
- Sales Comparison Approach
- Income Approach

The applicability of using any of the approaches is dependent upon the market data available for each individual appraisal.

A. Residential / Agricultural Property

Market value is the basis of value for properties in the residential subclass. In the agricultural subclass, buildings and other structures customarily associated with farming and agricultural lands that are vacant and unused, in accordance with Section 137.017(4), RSMo, are valued under the market value concept. Lands that are used for agricultural and horticultural purposes are valued in accordance with the land's productive capability and graded using one of the eight (8) grades published by the Commission.

One of the benefits of implementing the two-year ratio study cycle is the improvements made in the valuation process. One of the improvements involves researching and inspecting market information. Appraisers now have the time to look for additional sales information and to inspect the properties that have sold to verify their comparability to the subject properties. The second improvement involves documenting the methodology employed by the appraiser in arriving at the appraised value of the properties in the study. It is important in reviewing an appraisal that the reader, or reviewer, is able to arrive at the same value conclusion as the appraiser who prepared the report. Appraisal reports have been produced and reviewed digitally since 2005. Any data, information and documentation necessary to support the appraiser's opinions and conclusions are kept in a work file. The appraiser's work file is retained for a minimum of ten (10) years after preparation or two (2) years after the final disposition of any judicial proceeding in which the appraiser provided testimony related to the assignment, whichever period expires last.

In selecting counties for the ratio study, priority is given to those counties where preliminary research indicates potential valuation and/or other issues may exist that substantially impact the tax base.

B. Commercial Property

Market value is the basis of value for properties in the commercial subclass. As with the residential and agricultural appraisals, the two year ratio study cycle for completing the appraisals improves the final product. Benefits are gained in the improved appraisal reporting format and the additional time to investigate the marketplace for comparable sales and rentals that are essential to the valuation process. Beginning with the 2015 commercial ratio cycle, seventy-five (75) counties will be completed on a four year ratio cycle with approximately half of the counties being completed in each two year ratio study cycle. Forty (40) counties will be on a six year process with approximately one-third of the counties being completed in each two year ratio study cycle. This practice was deemed necessary due to budget and staffing reductions. In making the decision to extend the time frame for measuring commercial assessments in all Missouri counties, particular scrutiny was given to the complexities and nuances of the commercial real estate market. It generally takes longer to recognize trends in commercial real

estate due to the timing of leases and the overall scarcity of sales and income information available at any time, and historical information indicated that commercial assessments had far less variability between cycles than the residential subclass.

In selecting counties for the ratio study, priority is given to those counties where preliminary research indicates potential valuation and/or other issues may exist that substantially impact the tax base.

2. INTERNAL REVIEW

The internal review process consists of two components. The main component involves a review of the procedures used in the appraisal process and the second component is a desk audit for quality control purposes.

The review is completed by the appraiser supervisor who checks for compliance with internal policies and procedures. Supervisors use the market information supplied by the appraiser plus any supplemental available market data that might be obtained in the review process. Desk audits are completed by Management staff on an 'as needed' basis to assist in maintaining quality control and adherence to policies and procedures.

An illustrative sample of a residential appraisal report is shown in **Exhibit 4-17**. The appraisals may contain more information than is shown (zoning documents, maps, community information, etc).

Exhibit 4-17

MISSOURI STATE TAX COMMISSION RESIDENTIAL PROPERTY APPRAISAL

Owner's Name: Doe, John and Jane
Insp. Date: 7/4/2010 **Time:** 11:10 AM
Effective Date: 1/1/2011
Date of Report: 8/1/2010
USE RESTRICTIONS
This is a RESTRICTED USE appraisal intended for the use of the State Tax Commission only.

Situs Address: 123 Smith Street
Book: **Control No.:**
Appraiser: John Smith
Supervisor: Jane Jones
City: Anytown
Property Use(s): R : X A : C :
County/Sample Number: 1 / 1
Parcel Number: 1-22-333-444-55
Sec. 33 **Twp.** 96 **Rng.** 27 **Acres:** 0.34444
Use Code: 1
Assessed Value: $19,570
Appraised Value: $116,700
Legal Description: Lot 1 of Green Grass Subdivision

SALES DATA
Sales Date
Sales Price $:
Listing Date
Listing Price $:
OCCUPANT
☑ Owner
☐ Tenant
Received Verified STC Sales Letter
☐ Yes ☑ No
Owner Contacted for Sale History
☐ Yes ☑ No

APPRAISED VALUE
Site Value
☑ Sales Comparison
☐ Land Residual
☐ Market Extraction
☐ Ground Rent Cap.
☐ Allocation
Other
Lot Size: 100 x 150
Methods:

Value Conclusions		Final Value	
Cost:	$119,500	$22,700	L
Sales:	$116,700	$94,000	I
Income:		$116,700	T

THREE YEAR OWNERSHIP HISTORY
Property has not been sold in the past three years

Contact: No Owner Contact

FINAL VALUE RECONCILIATION
(Address all three approaches to value; the exclusion of any approach must also be addressed.)

The Cost Approach, using the Marshall Swift Residential Estimator, indicates a value of $119,500. The Cost Approach is somewhat limited in its reliability due to the age of the subject, however the depreciation on the property is reasonable due to adequate maintenance over the years.

The Sales Comparison Approach indicates a value of $116,700. The appraiser was able to utilize four comparable sales within the subject's immediate subdivision, two of which are on the subject's street. The sales considered are all similar to the subject in comparability and result in a well supported and narrow range of value.

The subject is in a neighborhood of owner-occupied housing with no rental data available; therefore the Income Approach was not applicable.

The Sales Comparison Approach is the most valid and reliable indicator of value for the subject property, relying on similar sales in the subject's immediate area. The Cost

RATIO STUDY DATA REPORT

Owner's Name: Doe, John and Jane
Situs Address: 123 Smith Street
City: Anytown
Parcel Number: 1-22-333-444-55

County/Sample No. 1 / 1
Date of Inspection 07/04/10

Discrepancy: ☐ Classification ☐ Mapping ☐ PRC Data

Appraiser's Comments:

Small difference in deck measurements.

Review Appraiser's Comments:

The differences noted are deemed to be insignificant, but may indicate the deck was replaced since the assessor's last inspection of the property.

SUBJECT PHOTOGRAPH SHEET

COUNTY-SAMPLE NUMBER: 01/01
PHOTO PAGE NUMBER: 1

Typical Street Scene:

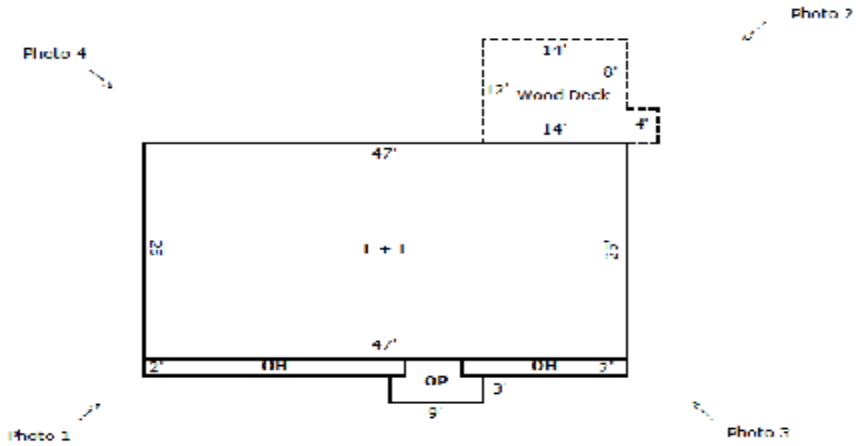
Typical Street Scene:

Front View of Subject:

Rear View of Subject:

Property Sketch

County - Sample Number: 1 / 1
Page Number: 1

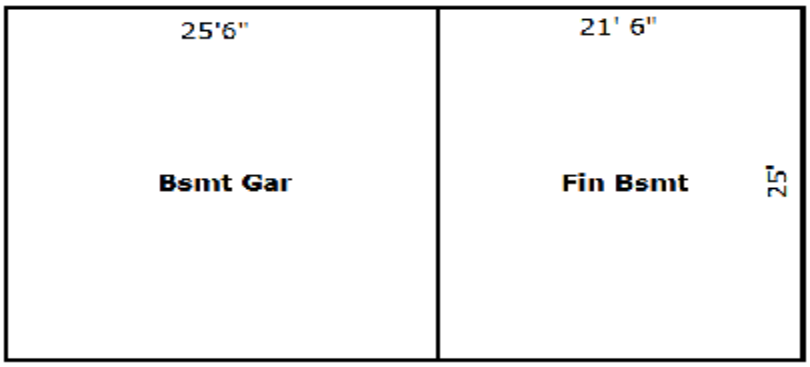


Area Calculations Summary

Living Area		Calculation Details	
OH	[illegible]	[illegible]	[illegible]
1 + 1	[illegible]	[illegible]	[illegible]
OH	[illegible]	[illegible]	[illegible]
Total Living Area (Rounded):	**1250 Sq ft**		
Non Living Area			
OP	[illegible]	[illegible]	[illegible]
		[illegible]	[illegible]
Wood Deck	300 Sq ft	[illegible]	300
		[illegible]	[illegible]

Property Sketch

County - Sample Number: 1 / 1
Page Number: 2



Area Calculations Summary

Non Living Area		
Unf Bsmt	175 Sq Ft	47 x 25 = 175
Fin Bsmt	543.5 Sq Ft	21.5 x 25 = 537.5
Bsmt Gar	637.5 Sq Ft	25 x 25.5 = 637.5

NEIGHBORHOOD/MARKET AREA DESCRIPTION

NEIGHBORHOOD

DEFINE NEIGHBORHOOD: Green Grass Subdivison

COUNTY-SAMPLE NUMBER: 1 / 1

Present Neighborhood Land Use(s)

PREDOMINANT USE: Residential

OTHER USES IN NEIGHBORHOOD: ☑ Single Family ☐ Multi- Family ☐ Farm/Vac. Ag ☐ Commercial ☐ Industrial Other:

NEIGHBORHOOD

LOCATION: ☑ Urban ☐ Suburban ☐ Rural

BUILT-UP: ☑ Over 75% ☐ 25 - 75% ☐ Under 25%

CHANGE IN LAND USE: ☑ Unlikely ☐ Likely ☐ Taking Place from _____ to _____

One-Unit Housing Trends

Property Values ☐ Increasing ☑ Stable ☐ Declining

Demand/Supply ☐ Shortage ☑ In Balance ☐ Over Supply

One-Unit Housing

Price $				Age (yrs)
$80,000			Low	30
$125,000			High	40
$90,000	-	$110,000	Pred.	35

SUBJECT

SUBJECT IMPROVEMENTS: ☑ Paved Streets ☐ Gravel Streets/Roads ☐ Sidewalks ☑ Street Lights ☑ Curbs & Gutters ☐ Off Street Parking Other:

SUBJECT TOPOGRAPHY: ☐ Level ☑ Gently Rolling ☐ Rolling ☐ Steep ☐ Low ☐ Flood Plain

SUBJECT SITE UTILITIES:

PUBLIC: ☑ Electricity ☑ Natural Gas ☑ Public Water ☑ Sanitary Sewers ☑ Storm Sewers

PRIVATE: ☐ Septic ☐ Lagoon ☐ Well ☐ Private Water Other:

SUBJECT

ZONING: ☑ In Compliance (Legal, Legal Non-Conforming) Other: ☐ No Zoning ☐ Unknown Zoning District: _____

State the use of the real estate existing as of January 1,2011: Residential

State the use of the real estate reflected in the appraisal: Residential

Does the property generally conform to the neighborhood (functional utility, style, condition, use, construction, etc.)?
☑ Yes ☐ No If No, describe:

SUBJECT HIGHEST AND BEST USE: ☑ Present If Other, explain:

EXPOSURE TIME ☐ Under 3 mths ☐ 3 - 6 mths ☑ Over 6 mths

General and Neighborhood Data Analysis/Market Conditions:

The subject is in a homogenous area of similar age/size/style homes in an area of town that is mostly developed. There is good access to major roads, and the subject is within walking distance of a public elementary school. Homes in area are similar in age, style and quality. Local market statistics show property values to be stable with adequate supply and demand, however homes are taking longer to sell at the present time.

There is no evidence of foreclosure activity affecting the subject's immediate neighborhood, and the sales researched do not show any loss in value vs. older sales.

When considering the subject's neighborhood, there are no negatives to report which would have a detrimental effect on value. The subject is in a desireable area that has a proven track record of marketability.

SALES COMPARISON APPROACH - SITE VALUATION

County-Sample No.: 1 / 1

ITEM	SUBJECT	SALE #1	SALE #2	SALE #3	SALE #4
Sale ID		157	158		
Situs Address	123 Smith Street	111 Good Drive	201 Curvy Road		
City	Anytown	Anytown	Anytown		
Parcel ID No.	1-22-333-444-55	1-21-22-23-24-25	1-24-25-27-19-22		
Site Size	0.34 100 x 150	0.22	0.24		
Prox. to Subject		1 mile SW	1 mile SW		
Date of Sale		1-2006	7-2006		
Sale Price		$20,000	$20,000		
Unit of Comp.		lot	lot		
SP/Unit		$20,000.00	$20,000.00		
Unit Size		1.00	1.00		
Source:		sto	sto		

Adjustments	Descriptions Dollar	%	Adj. Applied	+	Descriptions Dollar	%	Adj. Applied	+	Descriptions Dollar	%	Adj. Applied	+	Descriptions Dollar	%	Adj.Applied	+	Descriptions Dollar	%	Adj. Applied	±
Sale Price(SP)							$20,000.00				$20,000.00									
Prop. Rights	Fee Simple				Fee Simple				Fee Simple											
$ - % - Adj.																				
Adjusted SP							$20,000.00				$20,000.00									
Fin./Mkt. Cond.																				
$ - % - Adj.																				
Adjusted SP							$20,000.00				$20,000.00									
Other:																				
$ - % - Adj.																				
Adjusted SP							$20,000.00				$20,000.00									
Adj SP per Unit					$20,000.00				$20,000.00											
Unit / $					1.00		$20,000.00		1.00		$20,000.00									
Location	Urban Average				Slightly Inferior		1,500.00		Slightly Inferior		$1,500.00									
$ - % - Adj.					$1,500.00				$1,500.00											
Land Size	100 x 150				0.22				0.24											
$ - % - Adj.																				
Use	Residential				Residential				Residential											
$ - % - Adj.																				
Utilities	all				all				all											
$ - % - Adj.																				
Zoning	Residential				Residential				Residential											
$ - % - Adj.																				
Topography	Rolling				Rolling				Rolling											
$ - % - Adj.																				
$ - % - Adj.																				
$ - % - Adj.																				
$ - % - Adj.																				
$ - % - Adj.																				
Adj SP/Unit Size							$21,500.00				$21,500.00									
Net Adjustments						7.50%	$1,500.00			7.50%	$1,500.00									
Gross Adjust.						7.50%	$1,500.00			7.50%	$1,500.00									

Sales Comparison Approach - Site Valuation - Page 2 | County-Sample No. | 1/1

CALCULATIONS

	Adjusted Price	x	Unit		Value Indication
Basic Land Value	$21,500.00	x	1.00	=	$21,500.00
Excess Land Value		x		=	
			Total Land Value	=	$21,500.00
			Rounded Total Land Value	=	$21,500.00

SALES COMPARISON

Comments:

Comparable sales are located in a similar area with similar style and quality homes except that subject is located inside the city limits of Jefferson City and close to public elementary and middle schools. Subject slightly superior for these reasons. There was no market evidence to indicate that a time adjustment would be warranted. Subject has minimum landscaping along with concrete driveway. Appraiser estimates site improvements at $1,200. A total site value is $22,700.

MARKET EXTRAC./ALLOC.

SITE RECONCILIATION

SITE VALUE RECONCILIATION

Land Value $21,500 + Depreciated Site Improvements $1,200 = Total Site Value $22,700

COMPARABLE LAND SALE PHOTOGRAPH SHEET

COUNTY-SAMPLE NUMBER: 01/01

SALE 1 DESCRIPTION:

111 Good Drive

SALE 2 DESCRIPTION:

201 Curvy Road

SALE 3 DESCRIPTION:

SALE 4 DESCRIPTION:

SITE IMPROVEMENT VALUATION

COUNTY/SAMPLE NO: 1 / 1

Rounded Total "As Is" Value of All Site Improvements $1,200

IMPROVEMENT DESCRIPTION											DEPRECIATION						
Imp. No.	Structure Type	Quality	Class	Wall Type	Floor Type	Electrical	Plumbing	Diameter	Height	Age	TEL	REL	EA	Physical %	Other %	Total %	% Good
1	Septic																
2	Well																
3	Lagoon																
4																	

IMPROVEMENT COMPUTATIONS

Imp. No.	Base Costs		Adjustments					Adjusted Cost	Area	Total Basic Cost	Misc.	RCN	% Gd	RCNLD
	Page	Costs	Size	Hght.	Time	Local	Dollar							
1	STC Septic Study								1					
2	STC Well Study								1					
3	STC Lagoon Study								1					
4									1					

Septic/Well/Lagoon Depreciated Value	$0
"As Is" Value of Other Site Improvements	$1,200
Total "As Is" Value of All Site Improvements	$1,200
Rounded Total "As Is" Value of All Site Improvements	$1,200

Comments:

Subject has minimum landscaping along with concrete driveway.

Other Site Improvements Generally Include: Driveway, walkways, yard/landscaping, fencing, etc.

STC Input Data Report

Estimate Number:	405
Category:	ESTR

General Information

Building Data

Residence Type:	Single-family Residence
Style:	Bi-level
Total Floor Area:	1,258
Quality:	2.5 Fair/Average
Condition:	3 Average

Depreciation

Type:	M&S Table, M&S Typical Life, Condition Adj.
Cost as of:	December, 2010
Effective Age:	20
Typical Life:	53
Functional:	$0 plus 0%
External:	$0 plus 10%

Apply all percentages to Replacement Cost New

Component	Units/%	Quality	Depreciation
Exterior Walls			
107 Frame, Siding, Vinyl	100%		
Roofing			
208 Composition Shingle	100%		
Heating/Cooling			
351 Warmed & Cooled Air	100%		
Miscellaneous			
601 Plumbing Fixtures (#)	8		
602 Plumbing Rough-ins (#)	1		
622 Raised Subfloor (% or SF)	100%		
641 Single 1-Story Fireplace (#)	1		
Appliances			
502 Automatic Appliance Allowance			
Floor Cover			
402 Automatic Floor Cover Allowance			
Basement			
801 Total Basement Area (SF)	1,175		

Marshall & Swift/Boeckh, LLC and its licensors. Residential Estimator 7 - Input Data Listing
Estimate: 405
Date Printed: 5/6/2012
Page 1 of 2

Component	Units/%	Quality	Depreciation
803 Partition Finish Area (SF)	538		
805 Basement Garage, Single (#)	2		
Porch/Deck			
901 Open Slab Porch (SF)	38		
903 Wood Deck (SF)	180		
Land/Site			
691 Land Value ($)	21,500		
694 Site Improvements, Undepreciated ($)	1,200		

Additions

Remarks

TEL is 53

Overall well kept home in area of similar style, quality, and age of homes. Siding and windows appear to be fairly new, roof is fair with older AC. Overall no maintenance concerns at this time.

A test was conducted on the local multiplier and it was determined that 10% extra depreciation is needed to calibrate the Marshall & Swift costs to this market area.

Using the Marshall Swift Residential Estimator a Cost approach value of $120,700 has been determined.

Notes

Cost Adjustment

Local Multiplier:	1.01 (Default)	Local Multiplier Adjustment:	0 (Default)
Architect's Fees:	1.05 (Default)	Rounding Value:	1
Report Date:	12/2010 (Default)	Single-Line Backdate:	12/2010 (Default)
Base Date:	12/2010	Effective Age Adj. Value:	0 (Default)
Depreciation % Adj. Value:	0 (Default)	Energy Adjustment:	Moderate (Default)
Foundation Adjustment:	Moderate (Default)	Hillside Adjustment:	Flat
Seismic Adjustment:	No Adjustment	Wind Adjustment:	No Adjustment
Type Name:	None (Default)		

Marshall & Swift/Boeckh, LLC and its licensors. Residential Estimator 7 - Input Data Listing
Estimate: 405
Date Printed: 5/6/2012
Page 2 of 2

STC Cost Report

Cnty-Sample Number:	01-01
County Name:	Yancy
Parcel ID No.:	1-22-333-444-555
Year Built:	1975+-
:	
Situs Address:	123 Smith Street
City:	Anytown
State:	Missouri
Local Cost Code:	65300
:	
Intended User:	State Tax Commission of Missouri
Appraiser:	
Date of Inspection:	1/1/2011
Date of Appraisal:	01/01/2011

Single-family Residence		Floor Area:	1,258 Square Feet
Effective Age:	20	Quality:	2.5 Fair/Average
Cost as of:	December, 2010	Condition:	3 Average
Style:	Bi-level		
Exterior Wall:	Frame, Siding, Vinyl 100%		
Plumbing Fixtures:	8		

	Units	Cost	Total
Base Cost	1,258	56.86	71,530
Plumbing Fixtures	8	1,081.60	8,653
Composition Shingle	1,258	2.13	2,680
Raised Subfloor	1,258	7.24	9,108
Floor Cover Allowance	1,258	2.96	3,724
Warmed & Cooled Air	1,258	5.71	7,183
Plumbing Rough-ins	1	457.60	458
Single 1-Story Fireplace	1	2,990.00	2,990
Appliance Allowance	1	2,496.00	2,496
Basic Structure Total Cost	1,258	86.50	108,822
Total Basement Area	1,175	16.64	19,552
Partition Finish Area	538	24.51	13,186
Subtotal Basement			32,738
Open Slab Porch	38	6.33	241
Wood Deck	180	14.49	2,608
Subtotal Extras			2,849
Replacement Cost New	1,258	114.79	144,409
Physical + Functional Depreciation 23.0%			33,214
External Depreciation (10.0% RCN)			14,441
Total Depreciated Cost			96,754
Land			21,500
Site Improvements			1,200

Marshall & Swift/Boeckh, LLC and its licensors. Residential Estimator 7 - Standard
Estimate: 405
Date Printed: 5/6/2012
Page 1 of 2

	Units	Cost	Total
Non Building			22,700
Total			$119,454
Total, Rounded to Nearest $1			$119,454

Cost data by Marshall & Swift/Boeckh, LLC and its licensors.

Remarks

TEL is 53

Overall well kept home in area of similar style, quality, and age of homes. Siding and windows appear to be fairly new, roof is fair with older AC. Overall no maintenance concerns at this time.

A test was conducted on the local multiplier and it was determined that 10% extra depreciation is needed to calibrate the Marshall & Swift costs to this market area.

Using the Marshall Swift Residential Estimator a Cost approach value of $120,700 has been determined.

Marshall & Swift/Boeckh, LLC and its licensors. Residential Estimator 7 - Standard
Estimate: 405
Date Printed: 5/6/2012
Page 2 of 2

RESIDENTIAL SALES COMPARISON APPROACH — County-Sample No.: 1 / 1

ITEM	SUBJECT	SALE #1	SALE #2	SALE #3	SALE #4
Sale ID		316662831	-1132339962	1253	1255
Situs Address	123 Smith Street	129 Smith Street	199 Good Luck Lane	136 Smith Street	1204 Simple Street
City	Anytown	Anytown	Anytown	Anytown	Anytown
Parcel ID No.	1-22-333-444-55	11-22-77-99	32-55-66-64-22	123-456-789	312-34567-222
Site Size	0.34444	0.34	0.34	0.35	0.31
	100 x 150				
Prox. to Subject		1/2 blk	1 blk	1/2 block	1 blk
Date of Sale		2-2007	5-2007	2-2008	6-2008
Sale Price		$115,500	$117,000	$116,300	$115,500
SP/Unit		$99.74	$97.83	$98.23	$95.45
Gross Lvg Area	1,258	1,158	1,196	1,184	1,210
Source		STC	STC	Assessor	STC

Adjustments	Descriptions	Dollar	%	Adj. Applied	+	Dollar	%	Adj. Applied	+	Dollar	%	Adj. Applied	+	Dollar	%	Adj. Applied	+	Dollar	%	Adj. Applied	+
Sale Price(SP)								$115,500.00				$117,000.00				$116,300.00				$115,500.00	
Prop. Rights	Fee Simple					Fee Simple				Fee Simple				Fee Simple				Fee Simple			
$ - % - Adj.																					
Adjusted SP								$115,500.00				$117,000.00				$116,300.00				$115,500.00	
Fin./Mkt. Cond.																					
$ - % - Adj.																					
Adjusted SP								$115,500.00				$117,000.00				$116,300.00				$115,500.00	
Other:																					
$ - % - Adj.																					
Adjusted SP								$115,500.00				$117,000.00				$116,300.00				$115,500.00	
Adj SP per Unit							$99.74				$97.83				$98.23				$95.45		
Value Adjustments																					
Location	Urban Average					Similar				Similar				Similar				Similar			
$ - % - Adj.																					
Site Size/Amen.	100 x 150	$				0.34				0.34				0.35				0.31			
$ - % - Adj.																					
Style	Bilevel					Bilevel				Bilevel				Bilevel				Bilevel			
$ - % - Adj.																					
Year Built / EA	1975+-					1975				1975				1975				1975			
$ - % - Adj.																					
Construction Qual	Fair/Ave					Fair/Ave				Fair/Ave				Fair/Ave				Fair/Ave			
$ - % - Adj.																					
Condition	Average					Average				Average				Average				Average			
$ - % - Adj.																					
Rm/Tot/Bed/Bath	5 / 3	2				5 / 3	2			6 / 3	2.5	-$500.00		7 / 3	2			6 / 3	2.5	-$500.00	
$ - % - Adj.										-$500.00								-$500.00			
Gross Lvg Area	1258					1,158		$1,200.00		1,196		$750.00		1,184		$900.00		1,210		$675.00	
$ - % - Adj.						$1,200.00				$750.00				900.00				$675.00			
Basement	Full					Full				Full				Full	Yes			Full	Yes		
$ - % - Adj.																					
Finished Bsmt	538					552				681				424				Partial			
$ - % - Adj.																					
Functional Utility	Average					Average				Average				Average				Average			
$ - % - Adj.																					
Heating/Cooling	Warm & Cool					Warm & Cool				Warm & Cool				Warm & Cool				Warm & Cool			
$ - % - Adj.																					
Garage/Carport	Bsmt					Bsmt				Bsmt				Bsmt				Bsmt			
$ - % - Adj.																					
Porch/Deck																					
$ - % - Adj.																					
Fireplace	Yes					Yes				Yes				Yes				Yes			
$ - % - Adj.																					
Appliances																					
$ - % - Adj.																					
$ - % - Adj.																					
$ - % - Adj.																					
Adj. SP of Comp.								$116,700.00				$117,250.00				$117,200.00				$115,575.00	
Net Adjustments							1.00%	$1,200.00			0.00%	$250.00			1.00%	$900.00			0.00%	$75.00	
Gross Adjust.							1.00%	$1,200.00			1.00%	$1,250.00			1.00%	$900.00			0.00%	$1,075.00	

Residential Sales Comparison Approach - Page 2	County-Sample No.: 1 / 1

Value by Sales Comparison Approach

Land	$22,700
Improvement	$94,000
Total	$116,700

Comparable Sales Comments:

All of the comparables are similar to the subject in all major facets and would appeal to a similar buyer profile. All of the sales were built in the same time frame as the subject and have had similar maintenance over the years and exhibit a similar overall condition. There were few adjustments necessary because of the good comparability of the sales to the subject.

The sales information in the neighborhood does not support a time adjustment. It appears that values have stayed the same in this area of affordable homes since 2007, but there is no evidence of a market decrease in this neighborhood. The appraiser did not locate any foreclosure related activity in the area and local Realtors have confirmed that this particular neighborhood has not suffered from the declining/foreclosure areas in other parts of the community.

All of the comparables are very similar and none excel over the others in comparability. The appraiser gave equal weighting to the sales as they are all equal in their reliability as value indicators.

Reconciliation:

All of the comparables are very similar and none excel over the others in comparability. The appraiser gave equal weighting to each of the sales as they are all equal in their reliability as value indicators. A range of $115,575 to $117,250 is shown, $116,700 is used to indicate final value for the subject.

INCOME APPROACH (IF APPLICABLE)

Monthly Rent Amount: _____ Gross Rent Amount: _____ Sales Price: _____ GRM: _____

Estimated Monthly Market Rent $ _____ x Gross Rent Multiplier _____ = $_____ Indicated Value by Income Approach

Summary of Income Approach(including support for market rent and GRM)/Reconciliation:

The subject is in a neighborhood of owner-occupied housing with no rental data available; therefore the income approach was not applicable.

COMPARABLE IMPROVEMENT SALE PHOTOGRAPH SHEET

COUNTY-SAMPLE NUMBER: 01/01

SALE 1 DESCRIPTION:

129 Smith Street

SALE 2 DESCRIPTION:

199 Good Luck Lane

SALE 3 DESCRIPTION:

136 Smith Street

SALE 4 DESCRIPTION:

1204 Simple Street

3. EXTERNAL REVIEW - County Meeting

The external review phase is that part of the process that allows the assessor to have input into the appraisal study and may include a meeting at their request.

Upon completion of the internal review, the Tentative Ratio Study is completed. The individual samples, their assessment, and staff appraised values are detailed in a Ratio Report, a corresponding Statistical Report in sample order, and a corresponding Statistical Report in Ratio Order. These three reports along with a digital copy of the Ratio appraiser's county work are provided to the county assessor for review. The Ratio appraiser's county work will include each individual appraisal, special studies performed, county-city data, flood maps if required, etc.

The purpose of the external review is to secure any additional information that may assist the Commission in completing a fair and impartial study. The type of information typically obtained includes additional sales information, local factors that may have an impact on value, identification of incorrect parcels, land classification information, etc.

A member of the Local Assistance staff contacts the assessor to ask if a meeting to discuss the appraisals is wanted. At the meeting the appraiser receives input along with supporting documentation from the assessor on those properties on which the assessor wishes to comment. The comments are recorded on the County Meeting Review Form as shown in **Exhibit 4.18**. The purpose of the meeting is to obtain additional information, discuss the statistics that appear on the Statistical Report and to record any comments and concerns.

Exhibit 4-18

County Meeting Review Form

County Name: Date:
Review Appraiser: Appraiser:

Sample #	Original Value:	Final Value:

Discussion of Assessor's Issues	Reconciliation Comments:

Sample #	Original Value:	Final Value:

Discussion of Assessor's Issues	Reconciliation Comments:

Sample #	Original Value:	Final Value:

Discussion of Assessor's Issues	Reconciliation Comments:

Sample #	Original Value:	Final Value:

Discussion of Assessor's Issues	Reconciliation Comments:

After each meeting, the appraiser and review appraiser conduct site inspections of any properties for which new sales information is provided. They also re-inspect any property that requires a second review based upon information provided at the meeting.

After the meeting and any additional field reviews are completed, the appraiser and appraiser supervisor meet to review the appraisals in light of the comments and information obtained at the meeting. When an adjustment or change is warranted, they will then document their recommendation on the County Meeting Review Form. The appraiser will make the necessary changes in accordance with their agreed recommendations.

The final step in this part of the external review process is the generation of a revised ratio, referred to as the **Final Ratio,** and the redistribution of the final results to the county assessor.

4.8 DECISION MODEL

The Decision Model is the logical process to determine if a county is in compliance with State Tax Commission criteria for acceptable assessment performance. The diagrams on the following pages are used to illustrate the necessary steps used in the decision making process.

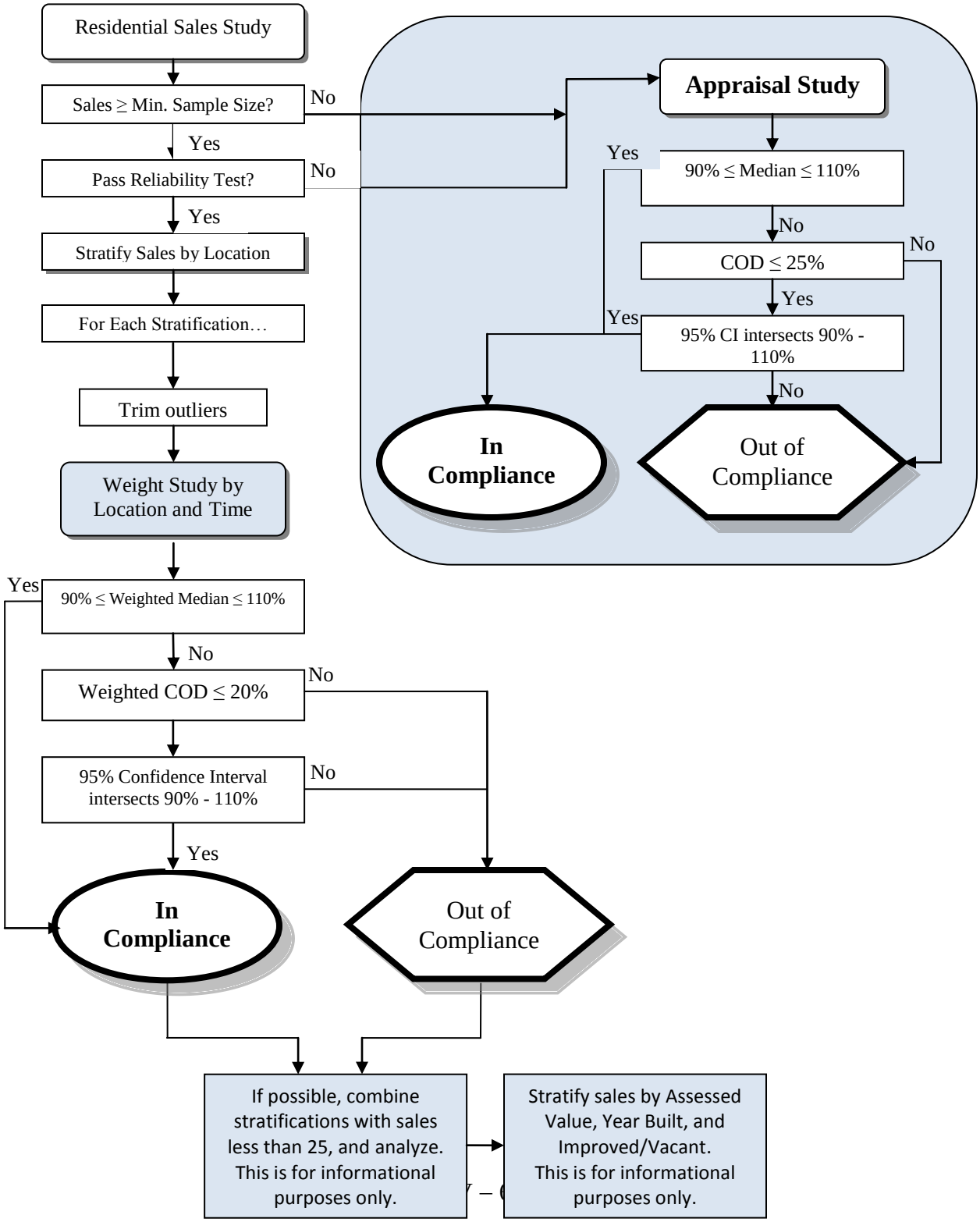
1. RESIDENTIAL DECISION MODEL

Beginning with the 2015 ratio study, there is a different decision model process for Traditional Sales Studies and Random Appraisal Studies.

For residential property, the Commission attempts to perform a Traditional Sales Study in all 115 assessment jurisdictions. If the Traditional Sales Study cannot be completed, then the Random Appraisal Study will be utilized.

For agricultural and commercial property, the Commission only utilizes Random Appraisal Studies.

The diagrams on the following pages illustrate the steps in the decision model process for residential property.


Residential Sales Study
Sales ≥ Min. Sample Size?
No
Yes
Pass Reliability Test?
No
Yes
Stratify Sales by Location
For Each Stratification…
Trim outliers
Weight Study by Location and Time
Yes
90% ≤ Weighted Median ≤ 110%
No
Weighted COD ≤ 20%
No
95% Confidence Interval intersects 90% - 110%
No
Yes
In Compliance
Out of Compliance
Appraisal Study
Yes
90% ≤ Median ≤ 110%
No
COD ≤ 25%
No
Yes
Yes
95% CI intersects 90% - 110%
No
In Compliance
Out of Compliance
If possible, combine stratifications with sales less than 25, and analyze. This is for informational purposes only.
Stratify sales by Assessed Value, Year Built, and Improved/Vacant. This is for informational purposes only.

A. **RESIDENTIAL SALES STUDY**

Further clarification on the Decision Model on the previous page:

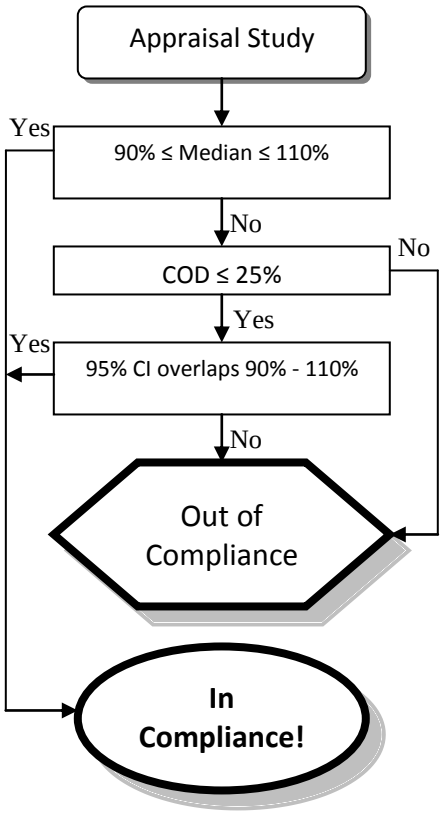
- Sales information and other data is collected from county assessors.
- A minimum number of sales is determined to reach an adequate sample size, taking sales from 6 months to up to 4 years into the past.
- A Reliability Test is performed to ensure the sales are representative and that the data is reliable.
- The sales are trimmed to remove influential outliers.
- Each sale is given a weight determined by the date of the sale.
- Sales are also given weight determined by the parcel's location, with more populous regions being given more weight than less populous regions.
- The STC defaults to school district as the preferred location variable, however the county can request other location variables.
- If the weighted median is within 90%-110%, the county is in compliance.
- If the weighted median is outside of the 90%-110% requirement, then the COD (Coefficient of Dispersion) is observed. If the COD is less than 20% and the weighted median 95% confidence interval overlaps 90% or 110%, the county is in compliance.
- If the median is outside of the 90%-110% requirement and the COD is greater than 20% or the confidence interval does not overlap 90% or 110%, then the county is out of compliance.

Stratification studies are done regardless of the outcome of the Sales Study, giving assessors information for different divisions of their county's sales.

- Each stratification is identified and observed individually in the study.
- In the case of the location stratification, if there are at least 25 sales in a location, then the sales ratios are trimmed and used to analyze properties in the area.
- If there are less than 25 sales in any location, then all locations with fewer than 25 sales are identified and then combined together.
- Each subset of sales (each school district, generally) is analyzed and the statistics for the ratio data is calculated and weighted by time. Individual location statistics are also provided to the assessor for informational purposes.
- The sales are also stratified by age (the year the building on the property is built), the assessed value, and whether the property is vacant or improved. These are split up into equal portions, usually quartiles, and each one is analyzed separately, providing information to the assessor.

B. RESIDENTIAL APPRAISAL STUDY

- A random appraisal study is performed for approximately 25 randomly selected parcels in the county.
- If the median is within the 90% - 110% range, then the county is in compliance.
- Otherwise, if the median is outside of the 90%-110% range, then the COD is observed.
- If both median and COD are out of tolerance, then the county is out of compliance.
- If the COD is less than 25%, then the median confidence interval must overlap either 90% or 110% to be in compliance.



2. AGRICULTURAL & COMMERCIAL DECISION MODEL

The decision model for agriculture and commercial property follows similarly to the residential decision model for the appraisal study (shown above). The only exceptions are that the allowable COD increases to 30% for agricultural and commercial property and these studies utilize approximately 30 samples as these subclasses have more variability than the residential subclass.

For agricultural or commercial appraisal studies, if the median is outside of the 90%-110% range, then the coefficient of dispersion must be less than 30%. If the COD is less than 30%, then the median confidence interval must overlap 90% or 110%.

4.9 STATISTICS

Statistics is the branch of applied mathematics that concerns itself with the collection of quantitative data, testing inferential hypotheses, and estimating population parameters using probability theory.

The statistics used by the Commission begins with a defined population. A **population** is the set of all entities the study finds of interest. All vacant and improved parcels residing in the residential subclass comprises the residential population for that county. A **simple random sample** is a representative subset of the population. A study is said to be **random** if each individual from the population has an equal chance of entering the set of sample selections. Samples are **independent** if the value or results of one individual does not affect another. The Commission utilizes both random (appraisal studies) and non-random (sales studies) sampling in the performance of ratio studies.

Data, the collection of factual information, is drawn from the study of each individual from the sample. The Commission uses both qualitative and quantitative values to form inferences that justify hypotheses. An **inference** is the deductive and inductive logical reasoning involved in forming a conclusion or premise. A **statistic** is the arithmetic metric that is derived from an inference to describe a sample. Statistics are often considered to be estimates that describe the population's true distribution and attributes. Examples of statistics include the sample mean, and the sample variance, s2. A **parameter** is an estimate of the population metrics. Such examples of a parameter would be the population mean, μ, and the population variance, $\sigma 2$. A **census** occurs when the entire population is included in the sample. It should also be known that statistics used to describe a sample are denoted with English letters whereas parameters are symbolized with the Greek alphabet.

Descriptive statistics summarize the distribution of the collected data. Knowing such information provides the ability to analyze and interpret characteristics that will be important for the study. The following sections list the important descriptive statistics used by the Commission in the performance of ratio studies.

1. MEASUREMENTS OF CENTRAL TENDENCY

The **mean**, also known as the arithmetic average, is created by adding together all individual samples and dividing by the number of samples. The sample mean $\bar{x}$ is computed as follows:

Let n represent the number of observations in the sample.
Let x_i represent the ith observation of the sample.

$$\bar{x} = \frac{x_1 + x_2 + \ldots + x_{n-1} + x_n}{n} = \frac{\sum_{i=1}^{n} x_i}{n}$$

The mean ratio is a helpful statistic. Some advantages of using the mean ratio include the ease in understanding the concept, the value of every ratio is considered, and further statistical applications can be used that are based around the value of the mean.

Table 1

Sample	Assessed Value	Sale Value	Ratio	Ratio/0.19
1	$5,780	$42,200	0.1370	72.1%
2	$100	$500	0.2000	105.3%
3	$5,720	$31,800	0.1799	94.7%
4	$3,230	$17,400	0.1856	97.7%
5	$11,540	$59,100	0.1953	102.8%
6	$1,330	$16,200	0.0821	43.2%
7	$4,580	$25,900	0.1768	93.1%
8	$3,290	$20,800	0.1582	83.3%
9	$3,840	$22,300	0.1722	90.6%
10	$5,350	$35,700	0.1499	78.9%
11	$160	$700	0.2286	120.3%

*Ratio/0.19 considers the residential assessment rate

For the mean ratio from the data provided in **Table 1**, one would add all of the ratio values together and divide by the number of samples. In this scenario,

$$\bar{x} = \frac{0.1370 + 0.2000 + ... + 0.1499 + 0.2286}{11} = \frac{1.8655}{11} = 0.1696 \Rightarrow {}^{0.1696}\!/_{0.19} = 89.26\%$$

The mean is a biased statistic. A statistic is biased when the expected value is not equal to the population's true value. The mean is biased because of the inherent properties of ratios. A ratio that is low can be overwhelmed by a ratio that is high. When a ratio of 50% (1:2) is averaged with a ratio of 200% (2:1), the result is 125% (5:4). The ratios signaling undervalued properties have a finite range of greater than 0 to less than 1, (0,1), and the ratios signaling overvalued properties have an infinite range of greater than 1 to infinity, $(1,\infty)$.

The **median,** $\tilde{x}$, is the middle observation when the values of the data are arrayed (listed from smallest to largest; or listed from largest to smallest).

If the number of observations is odd,

$$\tilde{x} = \left(\frac{n+1}{2}\right)^{th} \text{ ordered value.}$$

If the number of observations is even,

$$\tilde{x} = \frac{\left(\frac{n}{2}\right)^{th} + \left(\frac{n+1}{2}\right)^{th}}{2} \text{ ordered values.}$$

That is, if the number of observations is odd, the middle observation of the ordered data is the median. When the number of observations is even, the average of the two middle-most ordered observations is the median.

Table 2

Sample	Assessed Value	Sale Value	Ratio	Rank
6	$1,330	$16,200	0.0821	1
1	$5,780	$42,200	0.1370	2
10	$5,350	$35,700	0.1499	3
8	$3,290	$20,800	0.1582	4
9	$3,840	$22,300	0.1722	5
7	$4,580	$25,900	0.1768	6
3	$5,720	$31,800	0.1799	7
4	$3,230	$17,400	0.1856	8
5	$11,540	$59,100	0.1953	9
2	$100	$500	0.2000	10
11	$160	$700	0.2286	11

The median ratio is an ordered statistic that concerns itself only with the middlemost value(s). It is determined by listing the ratios in order and finding the one in the middle. **Table 2** shows the ratios listed

in an ascending (increasing) order.

Since there are 11 samples, n=11.

$$\tilde{x} = \left(\frac{n+1}{2}\right)^{th} = \left(\frac{11+1}{2}\right)^{th} = \left(\frac{12}{2}\right)^{th} = 6^{th} = 0.1768 \Rightarrow {}^{0.1768}\!/_{0.19} = 93.05\%$$

The **weighted median** is a statistic with often similar results to the median, but accounting for weight toward certain aspects. In sales studies, we weight the median by both time (when the sale was made in comparison to the date of assessment), and location (most often school districts). It is calculated by assigning a weight to each sale ratio, ordering the data from lowest ratio to highest, and taking the cumulative weight at each ratio. The ratios that lie just prior and lust after the middle weighting are averaged, giving the weighted median.

For example, the following data:

Sample	Assessed Value	Sale Value	Ratio	Rank	Weight	Cumulative Weight
6	$1,330	$16,200	0.0821	1	0.97431976	0.97431976
1	$5,780	$42,200	0.137	2	0.37591251	1.35023227
10	$5,350	$35,700	0.1499	3	0.68291225	2.03314452
8	$3,290	$20,800	0.1582	4	0.76941304	2.80255756
9	$3,840	$22,300	0.1722	5	0.87799612	3.68055368
7	$4,580	$25,900	0.1768	6	0.79930407	4.47985775
3	$5,720	$31,800	0.1799	7	0.58902894	5.06888669
4	$3,230	$17,400	0.1856	8	0.97559446	6.04448115
5	$11,540	$59,100	0.1953	9	0.96272843	7.00720958
2	$100	$500	0.2	10	0.83711521	7.84432479
11	$160	$700	0.2286	11	0.66527775	8.50960254

The total cumulative weight of the data is 8.5096. Half this number is 4.2548. The weights prior and after this number are 3.6805 and 4.4798. The ratios at these weights are .1722 and .1768. Averaging these two numbers gives us

$$(.1722 + .1768) / 2 = .3490 / 2 = .1745 \Rightarrow .1745/.19 = \mathbf{91.84\%}$$

The **weighted mean** is another descriptive statistic that describes central tendency. Weighted means generally are used in physics to describe moments of inertia and the center of mass.

However, the weighted mean can also be applied to population studies in statistics. The Commission measures the weighted mean in the ratio study. It is calculated by summing both the individual assessed values and the individual indicators of market value, sales prices or appraised values.

That is, for the weighted mean, $\ddot{x} = \frac{\sum Assessed}{\sum Appraised}$.

The weighted mean reflects the relationship of the total assessed value to the total market value of each subclass. From **Table 1**, the weighted ratio would be discovered using the following formula:

$$\hat{x} = \frac{\sum Assessed}{\sum Appraised} = \frac{\$44{,}920}{\$272{,}600} = 0.1648 \Rightarrow {}^{0.1648}\!/_{0.19} = 86.74\%$$

2. MEASUREMENTS OF VARIATION

The **Price Related Differential** (PRD) is found by dividing the mean by the weighted mean. This comparison tests for equity between low market value properties and high value properties. Disparate values suggest that inequities may exist. Therefore, the State Tax Commission has adopted the *IAAO Standard on Ratio Studies* recommendation that price related differentials should lie between 0.98 and 1.03.

A PRD above 1.00 suggests that the assessment values placed on high-value parcels are relatively lower than the assessment values placed on low-value parcels. The ratios for higher-valued properties would tend to be below the ratios for lower-valued properties.

A PRD below 1.00 suggests that the assessment values placed on high value parcels are relatively higher than the assessment values placed on low-value parcels. The ratios for higher-valued properties would tend to be above the ratios for lower-valued properties.

From the example above,

$$PRD = \frac{Mean}{WeightedMean} = \frac{89.26\%}{86.74\%} = 1.029$$

The **Coefficient of Dispersion** (COD) is a measurement of variability that assesses the horizontal uniformity of property. A lower Coefficient of Dispersion implies a lesser amount of variability. The COD measures the average percentage deviation of the ratios from the median ratio and is calculated from

the following steps:

1. Subtracting the median from each ratio.
2. Taking the absolute value of the calculated differences.
3. Summing the absolute differences.
4. Dividing by the number of ratios to obtain the "average absolute deviation."
5. Dividing by the median.
6. Multiplying by 100.

From the data in **Table 1**, the coefficient of dispersion has been calculated:

Ratio	0.0821	0.1370	0.1499	0.1582	0.1722	0.1768	0.1799	0.1856	0.1953	0.2000	0.2286
Step 1	-0.0947	-0.0398	-0.0269	-0.0186	-0.0046	0.0000	0.0031	0.0088	0.0185	0.0232	0.0518
Step 2	0.0947	0.0398	0.0269	0.0186	0.0046	0.0000	0.0031	0.0088	0.0185	0.0232	0.0518
Step 3	0.2900										
Step 4	0.0264										
Step 5	0.1491										
Step 6	**14.9116 %**										

Quartiles, like medians, are ordered statistics based on the nth observation. The median divides the data set into two distinct subsets: a lower subset and an upper subset. The lower subset consists of all data ranging from the minimum value to the median and the upper subset consists of all data ranging from the median to the maximum value. The **first quartile** is the median of the lower subset and the **third quartile** is the median of the upper subset. That is, when the data is ranked in ascending order, the data ranked at the 25th percentile is the first quartile and the data ranked at the 75th percentile is the third quartile. (The median can sometimes be considered as the second quartile.)

First Quartile	$\tilde{x}_1 = \left(\frac{n+1}{4}\right)^{th}$ ordered value.
Third Quartile	$\tilde{x}_3 = \left(\frac{3n+3}{4}\right)^{th}$ ordered value.

The **interquartile range** (IQR) is a metric that will help detect **outliers**. An outlier is an unusual observation that lies well below or well above what is expected. The interquartile range is calculated by subtracting the first quartile from the third quartile, taking the absolute value, and

multiplying that by 1.5. Take this quantity and subtract it from the first quartile. That is the minimum value for the IQR. The maximum value for the IQR is obtained by adding the same metric to the third quartile.

IQR = $\left(Q_1 - \left|Q_3 - Q_1\right| * 1.5 \ , \ Q_3 + \left|Q_3 - Q_1\right| * 1.5\right)$

Extrema are outliers that are considered to be implausible and have a heavy influence on many descriptive statistics such as the mean. Extrema ranges are calculated using 3.0 instead of 1.5 from the formula listed above.

EQR = $\left(Q_1 - \left|Q_3 - Q_1\right| * 3 \ , \ Q_3 + \left|Q_3 - Q_1\right| * 3\right)$

Example

From the data in Table 2 in which the values are ranked, the first quartile would be the 3rd observation, 0.1499 and the third quartile would be the 9th observation, 0.1953. The interquartile range would be found as follows:

IQR = $\left(0.1499 - \left|0.1953 - 0.1499\right| * 1.5 \ , \ 0.1953 + \left|0.1953 - 0.1499\right| * 1.5\right)$
IQR = $\left(0.1499 - \left|0.0454\right| * 1.5 \ , \ 0.1953 + \left|0.0454\right| * 1.5\right)$
IQR = $\left(0.1499 - 0.0454 * 1.5 \ , \ 0.1953 + 0.0454 * 1.5\right)$
IQR = $\left(0.1499 - 0.0454 * 1.5 \ , \ 0.1953 + 0.0454 * 1.5\right)$
IQR = $\left(0.1499 - 0.0681 \ , \ 0.1953 + 0.0681\right)$
IQR = $\left(0.0818 \ , \ 0.2634\right)$

The State Tax Commission's trimming process uses the Interquartile Range method (with a 3.0 coefficient) applied to the logarithmic ratios.

1. Calculate the ratios for each individual in the sample.
2. Transform the ratios using the natural logarithm.
3. Compute trimming parameters using the logarithmic ratios.
    a. First quartile Q_1; (25th Percentile)
    b. Third quartile Q_3; (75th Percentile)
    c. Interquartile Range; $\left|Q_3 - Q_1\right|$
4. Ratios below the lower limit, $Q_1 - \left|Q_3 - Q_1\right| * 3$, are removed.
5. Ratios above the upper limit, $Q_3 + \left|Q_3 - Q_1\right| * 3$, are removed.

The **standard deviation** measures a sample's level of variability and spread. Calculating the standard deviation of a distribution without the aid of a computer spreadsheet application can easily become a difficult task.

Step	The standard deviation of a sample is	$s = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}}$
1	First, subtract the mean from each individual, x_i	$x_i - \bar{x}$
2	Square each of these differences.	$(x_i - \bar{x})^2$
3	Add each of these differences together.	$\sum_{i=1}^{n}(x_i - \bar{x})^2$
4	Divide the sum of the squared differences by the number of observations minus 1.	$\frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}$
5	Take the square root of this value.	$s = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}}$

Using the data from Table 1, the Standard Deviation about the Mean would be calculated as follows:

Ratio	0.0821	0.1370	0.1499	0.1582	0.1722	0.1768	0.1799	0.1856	0.1953	0.2000	0.2286
Step 1	-0.0875	-0.0326	-0.0197	-0.0114	0.0026	0.0072	0.0103	0.0160	0.0257	0.0304	0.0590
Step 2	0.0077	0.0011	0.0004	0.0001	0.0000	0.0001	0.0001	0.0003	0.0007	0.0009	0.0035
Step 3	0.0147										
Step 4	0.0015										
Step 5	0.0384										

To calculate a **sample's variance**, another measurement of variability in a sample, use the same procedure as outlined above, but stop after step 4. That is, do not find the square root.

The **standard error in a mean ratio** measures the extent to which each individual ratio in a sample differs from that of the predicted value. The standard error of the mean ratio can be estimated using a predicted value of the population's standard deviation through the standard deviation of the sample.

Standard Error of Mean Ratio $= \frac{s}{\sqrt{n}}$.

Example:
Recall s=0.0384, as observed in the standard deviation calculation.
Recall n=11, which is the sample size.

The standard error of the mean ratio is $= \frac{s}{\sqrt{n}} = \frac{0.0384}{\sqrt{11}} = 0.01158$

A **confidence interval** is a range in which the true estimator of the population is expected to lie based on a predetermined percent of accuracy. For example, a 95% confidence interval gives a range of values. These values predict that the true mean of the population from which the sample was taken lies within the interval. As the confidence level decreases from 95%, the range becomes smaller. Similarly, if the confidence level increases from 95%, the range becomes larger.

The **median confidence interval,** unlike the confidence interval about the mean, is not based on the assumption of a normal distribution. It is found by ranking the data: sorting the data in order and assigning each data entry a number based on the value in relation to the others. If two or more data points are tied for the same rank, the rank assigned to these values is averaged.

After ranking the data, determine if the number of entries is even or odd. If the number is even, the number of observations one must count up and down from the median to find the control limits for the 95% confidence interval about the median is found by:

$$j = \frac{1.96 \times \sqrt{n}}{2}$$

If the number of observations is odd,

$$j = \frac{1.96 \times \sqrt{n}}{2} + 0.5$$

After determining the value of j, round the value up to the highest integer. From the values that are ranked, find the median, and count up and down j data entries to find the limits of the confidence interval.