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## Foreword: Purpose, users, results

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In recent years, we have seen many changes in Oregon’s property tax system. So it’s not unrealistic to anticipate revisions to assessment and appraisal procedures that reflect some of these changes.

One of the recent changes is the elimination of the statutory requirement for the cyclical revaluation. It is important that given this change, we don’t forget the need to maintain the integrity of the database. For the adjustment program to function properly, some level of physical revaluation will be necessary.

The purpose of this manual is to provide county assessors with the procedures for developing ratio studies as required by Oregon Revised Statutes (ORS) 309.200(A)(B)(C). The Department of Revenue must approve any deviation from the procedures set out in this manual.

Ratio studies are developed and used by county assessors to keep real market values current with changes in the real estate market place. Each year, assessors must measure the effect of these changes when placing values on the assessment and tax rolls.

This manual was developed by the Ratio Technicians Group and the Department of Revenue in a cooperative effort to provide a resource that is current and comprehensive. Through the efforts of the group, this manual contains the latest standard ratio procedures for use by all counties. This manual is consistent with the guidelines and teachings of the International Association of Assessing Officers (IAAO).

The manual is modified or updated on an ongoing basis. It can be accessed and downloaded at the department’s website at www.oregon.gov/DOR/PTD/ratio_manual.shtml.

If you have questions about this manual, please contact an Assessment and Taxation Standards (ATS) field office representative near your county seat.

Oregon Department of Revenue
Property Tax Division

ATS field office locations:
Bend: 951 SW Simpson Ave, Ste# 100
      Bend OR 97702
      541-388-6153
Eugene: 1600 Valley River Dr, Ste# 310
       Eugene OR 97401
       541-686-7939
Pendleton: 700 SE Emigrant Ave, Ste# 310
        Pendleton OR 97801-2596
        541-276-7811

Salem: 955 Center Street
       Salem OR 97301
       503-945-8585

Purposes of the ratio study

The purpose of the ratio study is:

- Provide guidance and direction to the assessor towards developing a certified ratio study and ratio report as required by ORS 309.200(A)(B)(C);
- Establish basis for testing of county valuation programs. It will create a source of data that will allow the county assessor and the Department of Revenue to measure results of the valuation programs;
- Provide a resource that demonstrates market-related criteria by which assessors can analyze appraisal and support staff requirements, and workload issues such as: new construction, reappraisal, etc.

Users of the ratio study

Data analysts: Data analysts display and interpret the real market value relative to the real estate market activity within a county, maintenance area, or market area. The assessors and data analysts use the manual as a resource and reference document for the annual presentation to county board of property tax appeals (BOFTA).

County assessors: Assessors are responsible for all aspects of the valuation, ratio, and adjustment programs. They may ensure adequate staff is available. Assessors conduct an ongoing supervisory review during the sales year and certify the completed study. They use the manual as a resource tool to determine areas of appraisal need and to develop real market value levels, demonstrating compliance with statutes. In small counties, the assessor may fulfill the task of preparing the ratio study.

Appraiser/analysts: Appraiser/analysts use the sales file and ratio study together as key elements in the management of their (determined) valuation area. Sales data will be extracted from the sales file that pertain to each area, and analyzed. Appraiser/analysts check for current real market value (RMV) levels by property class; review extreme ratios for possible errors in appraisals; and identify the need for further stratification of the sales data to determine whether there are separate market influences within the market area that is being measured. Appraiser/analysts also discover and add new sales data or confirmations to the study.
County governing bodies: County governing bodies use this study to establish potential funding, allowances for community services dependent upon (local) funding (i.e., police, fire, improvement districts, etc.). By statute, the county governing body also receives a copy of the department’s findings and recommendations letters sent to each assessor.

Department of Revenue (DOR): DOR conducts reviews of the assessor’s ratio programs and ratio reports to ensure compliance with statutory requirements; ensures equitable assessment levels; and monitors counties’ valuation programs by applying testing methods for determining appropriate valuation results.

State Legislature: The legislature uses ratio studies to view statewide performance of assessment programs.

State Department of Justice/Tax Court: The state Department of Justice/Tax Court uses ratio studies to establish reference documentation in support of local and statewide valuation appeals.

General public: Ratio studies are a resource document for residential, commercial, and industrial property owners for information regarding applied trends, market activity, sales data source, etc.

Results of the ratio study

- Maintain 100 percent of RMV as required by ORS 308.232;
- Maintain uniform and equitable values for all classes of property;
- Create a management tool for assessors;
- Establish DOR follow-up on “recommendation” issues. (ORS 309.203);
- Directs appraisal program evaluation (testing results);
- This manual is consistent with the guidelines and teachings of the international association of assessing officers (IAAO).
Section 1—Introduction

Each year county assessors develop a new assessment and tax roll. From one year to the next, the major change between rolls is the property values. Change is the one constant in the value of real estate. Changes may be gradual and not easily noticed, or changes may occur rapidly in an active market. Because property values are always changing, assessors must update the real market value (RMV) to keep them current. The process for measuring these changes is called the ratio study. The assessor is required to create a ratio study annually, per ORS 309.200.

Both state and local county assessment agencies use ratio studies to:

- Monitor appraisal performance.
- To determine the need for a general revaluation.
- Establish priorities for revaluation of selected groups of properties.
- Identify potential problems with appraisal procedures.
- Conduct market analyses.
- Adjust appraised values between revaluations.

The assessor’s ratio study compares the current certified roll RMV with the current market. Specifically, dividing the RMV by the sales price creates a ratio. Sales ratios show the percentage relationship between the RMV and the sales price. In the study, the ratio selected to represent the market area is referred to as the level of RMV, and it measures the degree to which the RMV reflects the current market.

The data used to calculate the relationship between RMV and the market are also used to calculate the uniformity and equity of the RMV estimates between properties. Uniformity and equity are measured by applying statistical formulae to sales ratios.

The ratio study is used to measure RMV levels and identify the amount of adjustment required to maintain RMV at 100 percent. This study is also used to measure the quality of appraisal programs. Dispersion and uniformity measurements are used to study how well appraisals are tracking with the variations in the market.

Recent changes in property tax laws increased the need for ratio analysis as an appraisal program management tool. To track program performance and analyze market trends, assessors, data analysts, and appraiser/analysts rely on market area analysis, and historical data, and RMV measurements such as: coefficient of dispersion (COD), coefficient of variation (COV), and price related differential (PRD). The Department of Revenue also relies on the certified ratio study to review the counties’ valuation programs for results and to determine the health of the statewide valuation system. Assessors and data analysts use the ratio study to develop an annual valuation plan to manage their annual appraisal programs.

The assessor is responsible for all aspects of the ratio study and adjustment program. This includes organizing the program, ensuring that adequate staff is provided, resolving policy questions, conducting an ongoing review during the sales year, and certifying the completed study. The department reviews the assessors’ programs and data to verify standards are met.

Adequate staff is essential to ensure sales collection and confirmation are up to date and that both the ratio study and adjustment program are completed in a timely manner.

The assessor is responsible for preparing the ratio study. In smaller counties, the assessor may fulfill the tasks of preparing the ratio study. In larger counties, a data analyst is assigned to perform the various duties related to sales collection and analysis. This person should have a strong knowledge of statistics and the ability to communicate effectively with the assessor, chief appraiser, support staff, data processing staff, and Department of Revenue staff. The data analyst works closely with each person providing periodic updates on the study’s progress, giving direction as needed, and identifying program objectives.

When necessary, additional support staff should be assigned:

- For deed (sales) take-off;
- To generate sales confirmation letters;
- To complete the sales records; and
- To input data.

The data analyst should periodically review the support staff’s work to ensure correct procedures are being followed.

All counties have automated systems to store, sort, and retrieve data. The assessor must ensure that the computer system meets the needs of the ratio and adjustment programs.

Statutes and administrative rules relating to ratio studies

Following are brief synopses of sections of the ORS and Oregon Administrative Rules (OAR) pertaining to ratio studies:
Basic steps to complete a ratio study

1. Collect sales for the time period January 1 through December 31. (See sections 1–4 of this manual.)
2. Verify sales for analysis. (See section 5 of this manual.)
3. Provide the sales database, including all rejected sales, to the Department of Revenue, if requested, under its supervisory responsibility and authority (ORS 306.115).
4. Create a sales file containing only qualified, usable sales.
5. Check outlier ratios for needed additional analysis before inclusion in the array. (See section 5 of this manual.)
6. Conduct a sales time-trend analysis by month and/or by quarter to determine if time adjustments are needed. (See section 6 of this manual.)
7. If a time trend is needed, trend each sale to the target assessment date. (See section 6 of this manual.)
8. Analyze each array, noting arrays that may need supplemental studies (e.g., multi-years, similar class combined, etc.). (See section 7 of this manual.)
9. Prepare and assemble the ratio study report. (See section 10 of this manual.)
10. File copies of the certified ratio study report with the Department of Revenue no later than July 1 per OAR 150.309.200(C).
11. The Department of Revenue will analyze each study and submit a letter of findings and recommendations to each assessor per ORS 309.203(2).
12. A certified copy of the assessor’s ratio study report must be filed with the county clerk as per ORS 309.200(2) no later than October 15.

This manual will guide the data analyst and other users through the sales ratio analysis process, the study procedures required, and the documenting and reporting of those processes and procedures.
Section 2—Ratio activities timeline

Sales collection year

The sales collection year begins January 1 and ends December 31. Sales information is collected, confirmed, sorted, determined to be usable or unusable, and the condition (reject) code is entered into the sales file. Periodically, the volume of sales data is checked and a plan is developed for additional studies, if necessary.

Ratio study year

ORS 309.200

The ratio study year begins immediately following the previous study year and continues until all processes are complete with the certified ratio study (see section 4). Sales analysis may be started earlier than the assessment date (see section 5). Sales listings are produced (see section 4). Sales ratios are computed and the sales data are analyzed (see section 7); change adjustments are established, if appropriate (see section 6). Additional studies are prepared as necessary (see section 10), and ratio study reports are completed (see section 10). Some important dates to consider are:

- **By February 15:** All sales should be entered into the database.
- **On or before July 1:** Certified copies of the ratio study are filed with the Department of Revenue for review.
- **On or before September 1:** The Department of Revenue provides written findings and recommendations to the assessor. A copy is sent to the county governing body. The assessor acts on recommendations of the department or provides written objections to the Department of Revenue.
- **September 25:** Assessment rolls are finalized.
- **October 15:** The assessor files a certified copy of the ratio study with the clerk of the board of property tax appeals.
Section 3—Property classification

Description

Each parcel of property within the state is classified in accordance with ORS 308.215. With the exception of specially assessed properties, the classification is based upon highest and best use of the property* and must be maintained on a continuing basis.

The basic property classes that are established by OAR 150-308.215(1)-(A) (Rev. 7/06) must be used to organize the sales data. For ratio studies, property class is the starting point for grouping sales data of similar properties for analysis. This sales grouping also facilitates determining adjustments and computing the weights of value components by property class by market area, countywide. When there are limited sales, related property classes may be combined to assist in reaching a conclusion of RMV levels. When adequate sales data are available, ratio data should be further stratified as appropriate.

The basic classes are also used to summarize the results of county ratio studies. The standard grouping allows for comparison between counties and for statewide analyses.

Multi-account sales

Only one property class should be included in the sales record. If a sale includes more than one parcel and they are different property classes, the predominant class should be used. These types of sales should be handled with caution, if they are to be used in the ratio study.

Basic property classes

OAR 150-308.215

<table>
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<tr>
<th>First Digit</th>
<th>Second Digit</th>
<th>Third Digit</th>
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<tr>
<td>0—Miscellaneous (See miscellaneous property, pages 3–4)</td>
<td>0—No significance</td>
<td>0—Vacant</td>
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<tr>
<td>1—Residential</td>
<td>1—Residential zone</td>
<td>1—Improved (typical of class)</td>
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<tr>
<td>2—Commercial</td>
<td>2—Commercial zone</td>
<td>2—Condominium</td>
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<tr>
<td>3—Industrial</td>
<td>3—Industrial zone</td>
<td>3—State responsibility</td>
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<td>4—Tract</td>
<td>4—Unzoned farm land</td>
<td>4—Partially exempt</td>
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<td>5—Farm</td>
<td>5—Exclusive Farm Use (EFU)</td>
<td>5—Taxable leased</td>
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<tr>
<td>6—Forest</td>
<td>6—Small Tract Forestland (STF)</td>
<td>6—Waterfront</td>
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<tr>
<td>7—Multi-family</td>
<td>7—Disqualified permanent FU</td>
<td>7—Mobile home parks</td>
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<tr>
<td>8—Recreation</td>
<td>8—Multiple special assessments</td>
<td>8—(Left blank)</td>
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<tr>
<td>9—Exempt (See exempt properties page 3–5)</td>
<td>9—Potential development</td>
<td>9—Manufactured structure</td>
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* A property’s highest and best use is that use found to be physically possible, legally permitted and economically feasible, and that returns the highest value to that property. If the property is improved, the land as if vacant and available to be improved to its highest and best use is first considered, and then the property as improved is evaluated. The higher value of the two is the highest and best use of the property.
1-0-0  **Residential land only** is an unimproved property that has residential use as its highest and best use, and the primary zoning is residential.

1-0-1  **Residential property** is an improved property that has residential use as its highest and best use.

2-0-0  **Commercial land only** is an unimproved property that has commercial use as its highest and best use, and the primary zoning is commercial.

2-0-1  **Commercial property** is an improved property that has commercial use as its highest and best use. This highest and best use is as income-producing property. Examples of commercial property include, but are not limited to: retail stores, supermarkets, discount stores, department stores, convenience marts, financial institutions, office buildings, small retail laundries, dry cleaners, medical and dental office buildings, recreational vehicle parks, hospitals, restaurants, theaters, automobile service stations and truck stops, automotive service centers, parking garages, car dealerships, hotels, and motels.

3-0-0  **Industrial land only** is an unimproved property that has industrial use as its highest and best use, and the primary zoning is industrial.

3-0-1  **Industrial property** is an improved property that has industrial use as its highest and best use. Industrial property includes, but is not limited to, those properties described by ORS 306.126, OAR 150-306.126(1), and ORS 308.408. Industrial property is typically located in an industrial zone, but may be located in areas with other types of zoning; for example, if it is a pre-existing or conditional use. Property use characteristics typically include assembly, processing, or manufacturing products from raw materials or fabricated parts and includes factories that render service; for example, large non-retail laundries and dry cleaners. Examples of industrial property include, but are not limited to, steel plants, foundries, chemical plants, and assembly plants; saw mills, plywood plants, and wood pulp or paper mills; high technology facilities, research and development facilities, science parks, and light and heavy manufacturing facilities; storage and distribution warehouses; and natural resource processing and refining facilities such as natural gas wells and rock quarries. Classification of property as industrial is a separate determination from appraisal responsibility. Department or county responsibility for appraising industrial property is described in OAR 150-306.126(1).

4-0-0  **Tract land only** is parcels of varying sizes of unimproved acreage where the highest and best use is for development to a suburban or rural homesite, but the land is not divided into urban type lots.

4-0-1  **Tract property** is parcels of varying sizes of improved acreage where the highest and best use is for use as a suburban or rural homesite, but the land is not divided into urban type lots.

5-0-0  **Farm and range land** is vacant land where the highest and best use is for the production of agricultural crops, feeding or management of livestock, or any other agricultural use, and the land is not specially assessed for farm use.

5-0-1  **Farm and range property** is land improved with buildings where the highest and best use is for the production of agricultural crops, feeding or management of livestock, or any other agricultural use, and the land is not specially assessed for farm use.

5-4-0  **Non-EFU zoned farm and range land** is vacant land that is under special farm use assessment by application.

5-4-1  **Non-EFU zoned farm and range property** is land improved with buildings that is under special farm use assessment by application.

5-5-0  **EFU-zoned farm and range land** is vacant land, which is under special farm use assessment by zoning.

5-5-1  **EFU-zoned farm and range property** is land improved with buildings, which is under special farm use assessment by zoning.

6-0-0  **Forestland** is vacant land, which has a highest and best use for growing and harvesting trees of a marketable species.

6-0-1  **Forest property** is land improved with buildings, which has a highest and best use for growing and harvesting trees of a marketable species.

6-4-0  **Forestland** is vacant land for which the highest and best use is other than growing and harvesting of trees of a marketable species, but the land has been designated as forestland by application.

6-4-1  **Forest property** is improved with buildings for which the highest and best use is other than growing and harvesting of trees of a marketable species, but the land has been designated as forestland by application.

6-6-0  **Small Tract Forestland property** is vacant land that is under special forestland assessment as Small Tract Forestland by application.

6-6-1  **Small Tract Forestland property** is land improved with buildings that is under special forestland assessment as Small Tract Forestland by application.

7-0-0  **Multi-family land** is unimproved land that has multiple housing (five or more living units) as its highest and best use, and the primary zoning is multifamily.

7-0-1  **Multi-family property** is an improved property that has multiple housing (five or more living units) as its
highest and best use. Multi-family property includes property developed as a manufactured housing park.

8-0-0 *Recreation land* is unimproved land that has recreational use as its highest and best use.

8-0-1 *Recreation property* is an improved property that provides recreational opportunity as its highest and best use.

**Use of second digit**

0  Indicates highest and best use and zoning are the same.

1, 2, 3  Indicates highest and best use and zoning are nonconforming. Example: A property has an improved residence and its highest and best use is for residential use, but it is located in a commercial zone. The property class would be 1-2-1.

4, 5  Indicates special assessment for farm-use and forest-use lands.

6  Indicates special assessment for Small Tract Forestland.

7  Indicates property permanently disqualified from farm or forest land use due to ORS 215.236 (non-farm dwelling).

8  Indicates property carries more than one special assessment; for example, combination of farm use and designated forestland or other combination of special assessments; or indicates government-restricted multi-unit rental housing that is specially assessed under ORS 308.701–ORS 308.724.

9  Indicates property has potential for further development; for example, it has been subdivided or it is subdividable.

**Miscellaneous property: Class 0-0-0**

The first digit denotes the major class: miscellaneous property.

The second digit indicates the basic class to which the property relates:

- 0-0  Miscellaneous property
- 0-1  Miscellaneous residential
- 0-2  Miscellaneous commercial
- 0-3  Miscellaneous industrial
- 0-4  Miscellaneous tract
- 0-5  Miscellaneous farm
- 0-6  Miscellaneous forest
- 0-7  Miscellaneous multifamily

- 0-8  Miscellaneous recreational
- 0-9  Miscellaneous exempt

The third digit is unique to the class:

- 0  Unbuildable-size, Department of Environmental Quality, easement or right-of-way
- 1  Improvement only
- 2  Mineral interest
- 3  Centrally assessed
- 4  Historic
- 5  Open space
- 6  (Left Blank)
- 7  Timeshare property
- 8  Enterprise zone
- 9  Manufactured structure

0-0-0  Real property manufactured structure

0-1-9  Personal property manufactured structure

**Exempt property: Class 9-0-0**

The first digit defines the property as exempt.

The second digit identifies the type of property or ownership:

- 9-0  Student housing
- 9-1  Church
- 9-2  School
- 9-3  Cemetery
- 9-4  City
- 9-5  County
- 9-6  State owned
- 9-7  Federally owned
- 9-8  Benevolent, fraternal ownership
- 9-9  Port properties or other municipal properties

The third digit is unique to this class and acts as an additional identifier:

- 0  Vacant
- 1  Improved
- 2  Partially exempt
- 3  Taxable leased property
- 4  In lieu of value
- 5  Temporarily exempt
Property classification

6  Native American holdings
7  (Left blank)
8  Mineral interest
9  Manufactured structure

Examples
9-0-1  OSU student housing
9-1-2  Church property with for-profit bookstore

Market areas

OAR 150-309.200(A) defines market area as a group of properties that generally share important characteristics that influence value. From a practical standpoint it is necessary that each market area should contain a sufficient number of accounts to ensure an adequate sale sample for analysis.

Typically, market area delineation is made along physical or geographic boundaries, or to describe a particular property use or type. In some instances, a specific market area could encompass the entire county or region. For example, manufactured structure parks, golf courses, motels, gas stations, or fast-food restaurants can be viewed as countywide market areas for analysis and adjustment purposes.

Market areas that compete with each other may be combined as one market area to generate enough sales for market analysis, whether contiguous or not. Supplemental studies are needed in markets where sales data are limited. Even though there are enough sales data, analysis of market activity in preparation of the sales ratio study may show the need for a more comprehensive analysis. Additional analyses may give a clearer picture of market trends. Therefore, the development of stratum such as building class, age, or lot size within a market area may be used as another tool for the valuation process.

Market area boundaries

Boundaries are used to delineate market areas. Dividing lines may be physical in nature (e.g., a river, railroad tracks, major thoroughfare, or highway, etc.) or by issues not so obvious (e.g., zoning ordinances and school districts). These types of boundaries are observed and defined by the actions of buyers and sellers in the marketplace.

Boundary changes in a market area should be made whenever analysis indicates change is needed. Care must be taken when making boundary changes so that the integrity of existing appraisals and previously applied adjustments do not distort the appraisal equity of properties within the redefined market area. This helps to ensure real market values will be equitably applied within each area.

From time to time, markets within a non-revaluation area also change. A subdivision may react differently than the rest of the properties in the market area, warranting a new market area designation. For example, a small town is designated as one market area. The area to the west of the downtown core area becomes very desirable, with demand escalating more rapidly than on the east side of town. The market analysis suggests that the town should be split into two market areas. Such a change will enable a more detailed analysis of the market activity, reflecting adjustments that more accurately represent RMV.

Ratio studies and the market area

One of the primary uses of the market area delineation is the assessor’s certified ratio study. The stratification of the sub-markets within a county helps the data analyst properly analyze market activity.

Market analysis allows for combining market areas where the market indicates areas are competing for the same buyers. Delineation allows for crossover of market area boundaries and results in a more accurate indication of market values.

Atypical ratio indications of a particular area may suggest “hot spots” in the real estate market. Upon closer inspection, high or low ratios may all occur in a specific location. The location may not be large enough to warrant the creation of new market area delineation; however, the sub-area can be analyzed and adjusted separately through a special study.

Market area stratification allows for individual adjustments by property class, property type, building class, age, etc., thereby adjusting properties to reflect accurate real market value levels. Additionally, adjustments or revaluations by strata within a market area produce greater uniformity among the individual properties, and hence better measurements of dispersion for the market area.

The market area analysis provides a tool to assess the validity of appraisals and the valuation process through the Computer Assisted Appraisal Program (CAAP).
purposes. A major use is the assessor’s certified ratio study. The identification codes provide the ability to determine the number and value of the various property class accounts within each market area. This allows appraisal supervisors to plan valuation schedules and other special projects.

Market identification codes must be updated periodically. Updates must be made when a property class changes or a zone change occurs [e.g., commercial land in a commercial zone (2-0-0s) is rezoned multifamily (7-0-0s)]. Such a change may result in a market area change if the 2-0-0 and 7-0-0 property classes are in separate areas.

Market area changes may occur as a result of a new plat. The parent account may dictate the same area identification for the new accounts or because of its location. However, the new plat could be given a new identification (area) code because of its location or be combined with an existing market area, depending on the market and characteristics of the new plat.

Once market areas have been established and property accounts coded, the market activity can be monitored with the aid of computer programs. Stratification of the market areas allows for meaningful analysis of market trends by property class. This leads to supportable adjustments and reliable real market values.

**Conclusion**

The definition and use of market areas are important tools in establishing real market values for all property classes. Properly utilizing market areas ensures that the value adjustments are applied to truly competitive properties as demonstrated in the market.
Section 4—Sales data collection and standard data format

The ratio study begins with collecting information on all sales throughout the county. All available sales should be used for each property class to provide an accurate reflection of the assessment program.

Sales data year

- The sales collection year is January 1 through December 31. Sales data collection must be organized, timely, and continuous. Each month’s sales should be completed by the last working day of the following month. The sales analysis process can be started prior to the first of the year. Sales processing should be completed as soon as possible so that the sales listings can be compiled to include all December sales by February 15.
- After the sales data have been gathered and arrayed, analysis and computation begin. This generally takes place between January 1 and July 1 (due date of the completed ratio study report). Analysis for the current year and sales collection for the coming year overlap. As statistical analysis begins for the current year, sales collection for the coming year is also taking place.
- The certified ratio study is to be finalized by July 1 or a date set by the department.

Market data sources

Sales information is taken from recorded instruments such as deeds, mortgages, and contracts. Other information from unrecorded sources, such as comments from realtors or appraisers, can be used only when thorough verification has been conducted.

Written procedures should be developed that outline the timely movement of sales information from the clerk’s office through the assessor’s office and then to the data analyst. This process is known as sales take-off. The data analyst needs to ensure that the sales collection, confirmation, and qualification process is current.

Data sources

- Primary sources for real property transactions include recorded and unrecorded property transfers such as deeds, contracts, and mortgages.
- Manufactured structure data is collected from recorded sale instruments and title transfers.
- Secondary sources includes individual buyers and sellers; records of real estate offices; multiple-listings services; title companies; government and private sector fee appraisers; building contractors; financial institutions; and developers.

Secondary sources are very important when data is limited. They can provide information regarding market activity. A banker may explain a policy regarding sales after foreclosure, i.e., whether a sale price is market value or liquidation value. Real estate brokers can verify whether a listing is above or below the market. Listing prices can be used in the ratio study for supporting data only when they are adjusted for the typical differences between the asking prices and final sale consideration. The adjustments must be developed in a special study.

Sales database

Pertinent information is maintained in a sales database. This is an organized filing system with related market information, such as prices and trends from actual sales, real estate publications, and regional economic and employment information. This information is used by the data analyst to understand market activity and can be used to develop special studies related to the ratio and adjustment program.

Property sale identification

It is important to identify each transaction in the computer generated sales database system with the appropriate map and tax lot numbers. Other identification numbers that can be used, but not to replace map and tax lot numbers, are:

- Account number;
- Reference number;
- Key number; and
- Serial number.

Note: If more than one account is included in a sale, all accounts need to be identified within the database.

Standard data format

ORS 306.125(1)

All Oregon counties now process assessment and taxation information by computer. This information must be submitted in standard data exchange formats, as required by ORS 308.215, 308.217, 308.219, 309.310, and 311.105.

The sales database should contain all pertinent information regarding transactions. The sales listings and related statistical data will be developed from the database. Not all information maintained in the database
is used to create the sales listings. The program should have the flexibility to sort on any of the data fields.

Data fields

The following data fields should be included in any sales database. This database need not be entirely separate from the assessment roll or other databases maintained by the county, provided the analyst is able to store, view, and retrieve the necessary information.

1. Grantor’s name—seller.
2. Grantor’s address (optional).
3. Grantee’s name—buyer.
4. Grantee’s address.
5. Account number—consists of township, range, section, and tax lot numbers.
6. Code area number—the taxing district code.
7. Instrument number—deed, volume, and page numbers; instrument number; or other identifying numbers to locate the recording of the deed or contract.
8. City—city code numbers (if used).
9. Building class—the principal building class as shown on the appraisal inventory record, computer printout, or envelope. Other buildings shall be coded by type, enabling separate adjustments, if necessary.
10. Year built—the year the principal building was constructed.
11. Percent good—a measure of depreciation (physical, functional, and economic) determined for the principal building.
12. Year appraised—the assessment year for which the field appraisal of the property was made. ORS 308.234.
   - This information allows separate studies of current RMV levels based on appraisals prepared in different years.
   - If the land and improvements were valued separately for different assessment years, the earliest date will be considered the year appraised.
   - For counties that recalculate, care should be taken to maintain the actual year of last physical inspection of the property upon which the basic characteristics were determined, e.g., square foot area, quality class, condition, other improvements, etc.
13. Appraisal area—appraisal area within the county.
   (See also “Market area.”)
   - Counties are no longer required to maintain six appraisal maintenance areas.
   - Counties may continue to maintain six appraisal maintenance areas or identify new appraisal areas based on their needs analysis and available resources.
14. Market area—a group of properties that generally share important characteristics that influence value. See OAR 150-309.200(A) and 150-308.234.
15. Acres—total acres included in the transaction (if available).
16. Ratio—a percentage obtained by dividing the RMV from the current certified roll by the sale price (SP).
   \[
   \text{Ratio} = \frac{\text{Roll RMV}}{\text{SP}}
   \]
17. Condition (reject) code—a code assigned to each sale to indicate whether the sale qualifies to be included in the ratio study. See section 5, pages 9–10, of this manual.
18. Condition code explanation—specific explanation as to why the condition code was selected.
19. Roll year—current assessment roll is the roll being prepared for the tax year beginning July 1 of the current calendar year, per OAR 150-309.200(A)(7).
   - Note: Prior year sales will have a different roll year than current year sales. These sales must be analyzed to determine if a trend exists and properly adjusted to the current assessment date.
20. Real market value—the RMV of land and improvements including manufactured structures taken from the current certified roll.
   - Caution: If the sale was vacant land, do not use the value of a new improvement or site improvements that may have been added to the roll. Likewise, if a parcel is consolidated or segregated after the sale, be sure the RMV does not include the consolidated or segregated value. Do not include increments of value that result from repair, remodeling, or additions that occurred after the sale. It is advisable to take the RMV at the time of the sale and make changes only to reflect adjustments or reappraisal.
   - If a sale involves more than one account, the total of the land and improvements from all accounts involved must be used. The combined total must reflect the total RMV from the current certified roll. These accounts must be “flagged” and cross-referenced in the sales file.
21. Sale price—the sale price or amount of consideration shown on the deed or contract.
22. Sale price data—(gathered from confirmation).
   - Terms: financing type, down payment, interest rate, and duration of the mortgage;
   - Conditions surrounding the sale (foreclosure, distress, open market, illness, length of time on market, etc.);
   - Encumbrances or liens assumed by the purchaser;
   - Adjustments to the sale price may include, but are not limited to: personal property, points paid by the grantor, repair allowances, or any exempt portions included in the selling price (designated forestland, timber, and historic property).
23. Date of sale—the date the sale instrument was signed or the sale price was agreed upon between seller and buyer. The recordation date indicates the date the transaction became public record.

24. Property class—outlined in chapter 3, see OAR 150-308.215(1)-(A), (Rev. 7/06).

25. County number (1 through 36)—usable for multi-county ratio study report (see list in appendices).

26. Instrument type—warranty deed, trust deed, contract, etc.

27. Zoning—residential, commercial, industrial, farm, etc.

28. Multiple-account indicator—more than one parcel (account) in transaction.

29. Comments.

30. Staff member confirming that sale.

31. Optional information—additional information may be captured, if determined appropriate. This may include items such as:
   - Storing an adjustment to a recorded price (for personal property);
   - Noting sales questionnaires have been sent or received;
   - Storing the adjusted sale price and date;
   - Identifying unusual properties (waterfront, etc.).

### Sales listing

Sales listings are developed from valid sales occurring during the sales year. Information in the sales listing shall include the complete identification of the property and the information necessary to develop an RMV adjustment factor.

After the sales are screened, confirmed, and coded, they are stored in the sales file until the sale listings are run. These sales form the primary sales listings and must be sortable by:

- Property class countywide;
- Property class for each market area or appraisal area;
- Property class for each market area, within each appraisal area; and
- Property class using sale date, by month and quarter.

These groups of sales are listed in ascending order according to the size of the ratio. This is called arraying. After the sales are arrayed, each sale is numbered in sequence.

### Sales listing format

The sales listing must be in tabular form. The following information should be transferred from each sale record:

- Appraisal area identification (number or letter);
- Property class;
- Market area, sub-area, down to the adjustment area level;
- Building class;
- Year appraised;
- Year built (for improved property classes);
- Percent good;
- Condition code;
- Account numbers;
- Township, range, section, and tax lot numbers;
- Code area number (taxing code) (optional);
- Instrument number;
- Number of acres (if required);
- Land RMV;
- Improvement RMV;
- Total RMV;
- Sale price (may be adjusted to consider items such as personal property);
- Sale date;
- Sale number;
- Sale ratio;
- Type of instrument; and
- Other accounts included in sale.

### Statistical data

A variety of statistical information is developed from the sales listings (see detail in Chapter 7), including:

- Sales ratio arrays in ascending order;
- Frequency distribution; and
- Central tendencies and related statistics.

#### Median

Average absolute deviation (AAD) and Coefficient of dispersion (COD)

#### Arithmetic mean

Standard deviation and Coefficient of variation (COV)

#### Weighted mean

Price related differential (PRD)

#### Geometric mean

#### Mode

Graphs (charts) showing trends in ratios should be included in the summaries. When data are lacking, graphs based on sales by quarter may have significance. The graphs provide a visual analysis of the change of ratio trends during the year. (See section 6.)
Sales data collection flowchart example

Clerk’s office

Recorded deeds and contracts

Tax collector’s office

Some address changes

Assessor’s office

Recorded deeds and contracts, address changes, and etc.

Mapping section

Maps & account # journal vouchers

Sales section sales data analyst (determines sales condition codes)

Sales confirmation letters

Research sales

Appraisers review of sales

Usable sales

Unusable sales

Stored sales database
Access by: Account code Property class Date Etc.

Ratio study
BOPTA comparables
Sales information for appraisal
Sales information
Analytical tool box

Used for:

Sales data collection and standard data format
Section 5—Sales transaction analysis

Sales confirmation

The assessor is responsible for developing written confirmation procedures. Real estate sales are considered when valuing property for taxation. Sales are also used to measure uniformity and the current level of real market value. Using sales for these purposes has been tested in the courts.

The sales database must include all transactions. Sales are analyzed to create a listing of valid sales and ratios. An attempt should be made to confirm all transactions by mail or personal contact. As data is collected, instruments should be carefully examined to identify characteristics of individual sales. Sales listings must indicate if the sale price has been adjusted.

The data analyst, registered appraisers, or other trained staff may complete confirmation duties. The staff person confirming the sale should be identified in the sale listing with a notation of the method used. Trained clerical staff may complete certain portions of the confirmation process, such as mailing and recording sales questionnaires, data entry, responses, and day-to-day filing.

Data analysts and appraisers will consider the selling price of each property and the selling prices of similar properties to determine the real market value (RMV) for many properties that have not sold. Current building and construction costs, income and expenses, age of the buildings, property condition, and location are considered.

Sales in the current appraisal/valuation area must also be included in the sales analysis process and included in the ratio study. However, ratios from these sales are only useful if the ratios are calculated using the new values. Including these sales enables the data analyst to determine and monitor the RMV level for the area with new values and whether any additional adjustment is needed to attain 100 percent real market value (ORS 308.232).

Methods of confirmation

Oregon law (ORS 308.233) requires the county assessor to:

- Review all property sales;
- Verify sales information; and
- Determine the real market values.

Typical confirmation methods are:

- Sale confirmation questionnaire;
- Telephone; and
- Field confirmation.

All methods of confirmation should follow a standardized format to maintain consistency of data and allow easy data entry. See samples at the end of this chapter.

Sales questionnaire letter

The questionnaire letter is the most widely used method of sale confirmation. The best responses are received when the letters are mailed close to the sale date.

- Questionnaires need only be sent to the buyers of residential properties.
- When a questionnaire is returned, the sale listing should be updated and the appropriate condition code applied (see page 5–4).
- If personal property is listed in the sale, determine if it is truly personal property, and if the reported value is accurate.
  - Buyers/sellers do not always understand what personal property is and may include real property items such as wall-to-wall carpet, a drop-in range, cook-top, hot tub, etc., as personal property. Check the appraisal record for these items to determine if valued as real property.
  - Personal property may be listed by the buyer at a retail value that exceeds its contribution to the sale price. Appraisal judgment should be used to allocate value to the personal property.
- Did the buyer assume unpaid taxes and/or other assessments not included in the sale price?

If responses from both the buyer and seller are received, they should be carefully compared. Things that you need to watch for in evaluating questionnaires are:

- Did the buyer and seller provide the same sale date?
- Did the buyer and seller confirm the sale price and related terms?

What other deductions should be noted?

Selling prices often include more than land and buildings. Many sales prices include furniture, machinery, livestock, timber, orchard trees, and farm crops. Non-taxable elements should be subtracted from the sale price. If the sale price includes timber, orchard trees, or farm crops, show the number of acres, type of item, and value allocated for each.

If a buyer assumes sewer or street assessments, delinquent property taxes, or other title clearing ownership expenses, these should be added to the sales price.
Sales transaction analysis

The reason for purchase is needed to help the analyst or appraiser group properties for the study. For example, a farm that is purchased for a subdivision or an industrial site would not be used to measure farm values.

If questionnaires require a follow-up call, the additional information should be entered in the sale listing, be attached to the original questionnaire, and placed in the file.

**Telephone contact**

Telephone confirmation is a good method of confirming sales with the grantor, grantee, or broker directly involved in the transaction.

Using the questionnaire as a guide ensures that the information gathered is consistent. The caller should organize the interview prior to the call to ensure all necessary questions are asked and answered in one contact.

**Personal interview**

Complex property transactions, such as commercial, industrial, and farm properties often require confirmation in person. Such sales usually involve both real and personal property.

A questionnaire should be used as an “inquiry guide” to ensure that the information gathered is consistent. Additional questions should be added that are specific to the type of property.

**Consideration from instrument**

“Consideration” is the term used to denote “the recorded price for which title to a property is transferred.” Caution must be exercised when using the consideration directly from the recording instrument (deed, contract) without initiating any confirmation. This practice should only be used for residential properties in counties where there are a large number of sales, and the sample is representative of the properties in each market area. Large quantities of sales can generally minimize the effect of extreme ratios on central tendencies.

**Analysis of individual sales**

In evaluating each sale, it’s critical to determine whether the sale meets the standards for inclusion in the ratio study. This analysis considers the following:

**Quality of sale data**

- Has the sale been confirmed?
- Is the source reliable?

- If not confirmed, what is the quality of the information available?
- If the sale data are questionable, what further study is necessary?

**Extracting personal property and other items**

- Does the amount extracted appear reasonable?
- What was the source of the value estimate?
- What is the source of any revised value?

**General acceptance of sales**

If a sale cannot be confirmed and there is no apparent reason to reject it, the sale must be included in the study. An extreme ratio is not reason to reject the sale. Attempts to confirm these sales should be documented in the sale listing. It is important to document when questionnaires were mailed and telephone contact was attempted.

**Identifying sales as usable or unusable**

**Qualifying sales for use in ratio study**

Often there is sufficient information on the recorded instrument to support rejecting the sale for use in the current ratio study, before any confirmation is attempted.

Items that may invalidate a sale include:

- **Recording dates:** Deeds recorded at approximately the same time with reverse grantor and grantee may indicate a trade.
- **Property description:** Partial sales and segregations may be indicated by the property’s legal description. A partial interest also would be indicated by the sale of a vendor’s interest in a contract or by a deed to secure financing (a trust deed).
- **Consideration:** This should be checked carefully to determine whether the sale price includes additional property or value.
- **Invalid document:** Ineligible grantee/grantor; incorrect legal description, etc.

Condition codes (listed on page 5-4) indicate the reason the sale is accepted or rejected. They are displayed in the **condition field** in the sale listing. After each sale is confirmed and coded as to its usability in the sales ratio analysis process, all of the sales can be sorted by the condition code desired by the analyst.

Condition codes fall into two categories:

1. **Usable**
   - All confirmed arm’s length transaction sales.
   - Unconfirmed sales that appear to be arm’s length transactions.
• Sales that may be usable for additional studies for measuring real market value levels if the data is corrected, confirmed, or further analyzed.
• Condition Code 21 (sold not same as appraised): If property sells in a condition that is different from the way it had been valued, it can be re-valued as if it existed that way when originally appraised (using the same date of value and appraisal procedure).

Example: A property had been remodeled since the last revaluation without the records being adjusted to reflect the change. You can adjust the percent good, square footage/area, etc., to reflect the RMV that would have been used at the time of the last revaluation, trended forward.

• IRS Revenue Code (IRC) 1031 exchanges: These are in almost all cases valid transactions between knowledgeable parties, who have researched the available market, and who have conducted this lawful transaction through an “accommodator” to legally defer a capital gains tax. One of the main criteria in this kind of exchange requires the party selling an investment property to reinvest in like kind of property for equal or greater value than the relinquished property. Acceptable exchanges under IRC 1031 include real property with real property, personalty with personalty, aircraft with aircraft, etc., of equal or greater value. These transactions are also subject to time-period limitations to successfully comply. Like all other market transactions, these also need to be verified for value and any additional property.

The following may be potentially usable sales:

Transfers by government agencies and financial institutions may have significant influence in the real estate market. Sales by these grantors must be confirmed to establish if the sale price is indicative of the market or if it is a liquidation sale. Certain federal agencies transfer title only with quitclaim or bargain and sale deeds. Such sales should be confirmed and included in the sales listing, if:

• The grantor was a federal, state, county, municipal, or other political subdivision.
• The grantor was a bank, savings and loan, title company, finance company, or other financial institution.

Sales that were initially rejected because the instrument was not a valid deed or contract should be confirmed. Depending on the results of confirmation, these sales may be usable in the sales listing or in an additional study.

2. Unusable
• Sales that are not open-market transactions (i.e., do not comply with the real market value definition).
• Unconfirmed sales that appear to be other than arm’s length transactions. (This assumes that all reasonable attempts to confirm have been exhausted.)
• Sales that do not represent the property that was appraised (Condition Code 21), such as residential property sold for commercial use or the conversion of a garage to living area.
  — At a later date, Code 21 could be broken into two categories: a) changes to property that occurred recently and would be picked up during annual field inspections, often referred to as “maintenance” or “red tags”; b) changes to property that occurred in prior years and data collection was missed as omitted property.
• An unusable sale classification does not include “out-of-town purchaser” or unexplained extreme ratios.

Sales or transaction instruments deemed “unusable” for the ratio study purposes may have valid uses in other studies, such as appraisal set-up studies, etc.

For the following sale conditions only a condition code is required for the sale listing:
• The grantor is a sheriff, receiver, or other court officer disposing of property under a judicial order or administrative proceeding.
• The grantor and grantee are the same, and the deed merely changes the nature of the interest in the property.
• The transaction conveys an undivided interest with no value.
• A tenancy in common is created.
• A tenancy by the entirety is created.
• Grantor and grantee are related, and no value is conveyed.
• The sale is a dedication to the public.
• The instrument is a security conveyance for financing purposes, i.e., trust deed.
• Adjacent owners are exchanging property, and no value is conveyed, i.e., lot-line adjustment.
• The “sale”/instrument is a partial release of a mortgage.
• The transfer is in lieu of foreclosure.
• The transfer involves a death certificate.
• The instrument is a re-recording or correction deed.
• The transaction is a conveyance of seller’s contract balance; no real property is involved, i.e., memorandum of contract.

Note: Sales deemed unusable for ratio analysis may be useful in appraisal area set-up studies. Make proper adjustments for date of sale and any subsequent changes to the property since the last appraisal or valuation.
Sales data condition (reject) codes

ORS 306.120; OAR 309.200

The following list of condition codes is used to categorize and identify the circumstances of each property sale transaction in each county. This list can be expanded to fit the individual needs of a county.

<table>
<thead>
<tr>
<th>Code no.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Change of use.</td>
</tr>
<tr>
<td>2.</td>
<td>Deed does not show warranty of title.</td>
</tr>
<tr>
<td>3.</td>
<td>Grantee/grantor is a political subdivision (government agency).</td>
</tr>
<tr>
<td>4.</td>
<td>Grantee is a bank or other financial institution, or lender foreclosure.</td>
</tr>
<tr>
<td>5.</td>
<td>Grantee is charitable, religious, or other institution.</td>
</tr>
<tr>
<td>6.</td>
<td>Grantee and grantor are related or business associates.</td>
</tr>
<tr>
<td>7.</td>
<td>Conveyance of partial or divided interest.</td>
</tr>
<tr>
<td>8.</td>
<td>Grantee and grantor are the same, transfer of convenience.</td>
</tr>
<tr>
<td>9.</td>
<td>Trade... (exchange of properties).</td>
</tr>
<tr>
<td>10.</td>
<td>Conveyance of property to avoid lien/foreclosure.</td>
</tr>
<tr>
<td>11.</td>
<td>Grantor is sheriff or other court office (administrator), receiver, guardian, trustee.</td>
</tr>
<tr>
<td>13.</td>
<td>Critical field on deed/document left blank.</td>
</tr>
<tr>
<td>14.</td>
<td>Prior year’s real market value or sale price missing.</td>
</tr>
<tr>
<td>15.</td>
<td>Date of sale missing.</td>
</tr>
<tr>
<td>16.</td>
<td>Sale includes personal property, which cannot be accurately extracted.</td>
</tr>
<tr>
<td>17.</td>
<td>Sale includes orchards, crops, or other exempt properties.</td>
</tr>
<tr>
<td>18.</td>
<td>Mortgage balance is not noted.</td>
</tr>
<tr>
<td>19.</td>
<td>Error in classification (unless corrected by reclassification).</td>
</tr>
<tr>
<td>20.</td>
<td>Other errors or omissions (miscellaneous)—<strong>must</strong> explain under “Reasons for Rejection.”</td>
</tr>
<tr>
<td>21.</td>
<td>Property sold is not the same as valued for the current certified roll. This does not include General Ongoing Maintenance and Repair (GOMAR) unless there is an “exception value” included.</td>
</tr>
<tr>
<td>22.</td>
<td>Sale includes designated forestland and/or timber.</td>
</tr>
<tr>
<td>23.</td>
<td>Sales of properties that have had the real market value adjudicated by BOPTA, DOR, or the Tax Court (in the past five years) beginning with real market values adjudicated after October 3, 1989.</td>
</tr>
<tr>
<td>30.</td>
<td>Usable, but <strong>unconfirmed</strong>, within current sales year.</td>
</tr>
<tr>
<td>31.</td>
<td>Unconfirmed <strong>prior</strong> year’s sale adjusted for time and used in current year’s ratio study.</td>
</tr>
<tr>
<td>32.</td>
<td>Confirmed prior year’s sale adjusted for time and used in current year’s ratio study.</td>
</tr>
<tr>
<td>33.</td>
<td>Confirmed sale.</td>
</tr>
</tbody>
</table>

**Sample sales confirmation letter follows**
Account number:

Sales verification questionnaire—example

Buyer  Seller  Recording#
Recording#  Sale date  Sale price

Map #  Location

If the information above is wrong, please note corrections below:

Buyer: _______________________________________________________
Seller: _______________________________________________________
Location: ____________________________________________________
Sale price: __________________________________________________

Check any of the following that might disqualify this sale as being a good indicator of market value:

☐ Buyer and seller were related prior to the sale as (circle one):
    family    friends    business associates
☐ An estate sale
☐ Purchase of a partial interest only
☐ Received property back (for example, in lieu of foreclosure)
☐ Forced or distress sale (for example, court order, divorce)
☐ Transfer of convenience (for example, correct defects in title, create joint tenancy)
☐ Restriction on use (life estate, detrimental easement)
☐ Satisfaction of land sale contract
☐ Exercise of option. The option was agreed upon ____________________________
☐ An exchange of property: located at ________________________________
☐ Any other unusual circumstance which might disqualify this sale from being a good indicator of market value? Please explain:
________________________________________________________________________
________________________________________________________________________

When did you agree on the sale price? ________________________________

In addition to the sale price did you:
assume back taxes in the amount of ________________________________
assume city or county assessments (Bancroft liens, etc) in the amount of __________________

Was Personal property included in the sale price?   Yes   No
    If yes, please circle items: furniture   appliances   equipment   vehicle   Other __________
    Estimated value of personal property __________________________________________

Was a Manufactured structure (mobile home) included in the sale price?   Yes   No
    If yes: Brand ________________________________________________
    Estimated value: ____________________________________________
Sales transaction analysis

To your knowledge, have alterations or improvements been made to the property in the past year?

☐ Yes
☐ No

If YES: please explain:
☐ Remove old building(s)
☐ Add new building(s)
☐ Remodel. Nature of remodel ________________________________
☐ Other ________________________________

Was your purchase through a realtor?  ☐ Yes  ☐ No

If not, how did you hear about this property? ________________________________

If you know, how long was the property on the market? ________________________________

In your opinion, was the price paid a fair value?  ☐ Yes  ☐ No

If not, please explain ________________________________

What is the present use of the property? ________________________________

Is the intended use of the property the same as the present use?

☐ Yes  ☐ Different ________________________________

If this purchase is bare land, please indicate which site improvements were available before or after your purchase:

<table>
<thead>
<tr>
<th>Before</th>
<th>After</th>
</tr>
</thead>
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</table>

If this purchase contains farm land: is the land leased?  ☐ Yes  ☐ No

If yes: number of acres leased _____________  date of lease ___________________________
Length of lease _____________  Rent received per month or year ____________

If this purchase contains timber or timberland:

Did the purchase include timber?  ☐ Yes  ☐ No

If yes: number of acres _____________  Type of timber ___________________________
Estimated age of timber _____________  Estimated value of timber _____________

Thank you for your cooperation.

Submitted by ________________________________  Phone number ________________________
Explanation of sales questionnaire

Example of accompanying information to the property owner receiving a sale verification letter.

Why is the information needed?
Sales of real estate is used as the main factor in establishing the real market value levels for land and improvements within a county. Sales are also used to measure uniformity of values to ensure that all taxpayers’ properties are valued consistently with other like types of property. The use of sales for these purposes is required in statutes and has been tested in the courts.

How will the information be used?
Trained appraisers will consider the selling price of your property and the selling price of similar properties to determine the real market value for many properties. Current building construction costs, income and expenses (if the property being appraised produces income), age of the buildings, location, etc., will also be considered.

Why are so many questions asked about my property?
Selling prices of property often include more than just the land and buildings. Many sales prices include furniture, machinery, livestock, and farm crops. The value of these items is considered separately (deducted) from the total selling price when the sales are analyzed by appraisers. The value(s) the appraisers work with is the total purchase price paid for the land and buildings. The reason for purchase is needed to help the appraisers group properties for study. For example, the selling price of a farm purchased for subdivision or as an industrial site would not be used to measure farm values.

What other deductions should be noted?
Crops, timber, plants, and orchard trees are not taxable. If your purchase price included any of these items, please show the number of acres and type of item. Property included in the sale that is not assessable for property tax purposes would be subtracted from the total price of the property to permit analysis for the land and buildings. Amounts paid to the seller for sewer or street assessments, property taxes, or other expenses should be listed.
Section 6—Adjustment for change

Purpose

Market conditions may create the need for an adjustment to sales prices that occurred during the sales year to January 1 of the year following sales data collection. Time itself is not the cause for the adjustment; it is the movement of value over time. The adjustment change is expressed as a percentage of increase or decrease to sales prices to reflect what the property would have sold for as of the assessment date. If market conditions have not changed, no adjustment is required, although a considerable amount of time may have passed.

Change adjustments are used to adjust the individual sale prices to reflect market conditions on the assessment date. In addition, change adjustments are used when sales outside the current sales year are used to supplement insufficient sales sampling for ratio analysis. These additional sales are combined with current sales for a supplemental study. In the ratio study, change adjustments (or no change adjustments) must be supported by analysis.

Types of trends

Recognizing that more than one type of change trend exists will provide a better understanding of the conclusions developed by the ratio study process.

Trends can be defined as a statistically detectable change in value over time due to the actions of buyers and sellers in the market place. There are many types of change-related trends. The analyst must recognize the correct trend for the current purpose. These trends may be local, regional, and/or nation/world wide. Some of the more familiar trends include:

- **Economic trend**
  A general, all–encompassing trend logically based on economic factors.

- **Cost trend**
  The rate of change in construction costs.

- **Market trend**
  A market trend is the rate of change of market prices for specific classes of properties, such as multi-family residential, commercial, etc. Market trends are often set by or follow local, statewide, or regional economics. These trends can often be delineated along market areas and should be measured by market area.

- **Long–term trend**
  A long-term trend is the rate of change over a number of years. Some industries such as housing or wood products experience dynamics that may or may not change rapidly and are cyclical in nature. These industry-wide changes may reflect changes in supply (resource shortage) and demand (demographic change).

- **Annual trend**
  An annual trend is the rate of change from one year to the next or any 12-month period.

- **Seasonal trend**
  A seasonal trend is the rate of change over a few specific months. This would also include winter use areas, summer use areas, financial reporting quarterly periods, etc.

- **Seasonal variation**
  The seasonal variation is a consistent relationship between an annual trend and a seasonal trend.

- **Short–term trend**
  Rate of change calculated over a few months or weeks. This may be used to determine the direction of the market at a point in time.

Change trend analysis

Change trends are developed by grouping sales ratios by month and/or quarter and are summarized in sales ratio listings. These ratios can be graphed to determine change trends. A change adjustment developed using a ratio trend is usually accurate if there are an adequate number of sales per analysis period (month or quarter). This number may vary depending on the population size of the area you are measuring. Statistically, 20 sales per period have been used as an acceptable guide. However, many counties will fall short of this number on a continuous basis. Caution, judgment, and supplemental information need to be utilized when creating change adjustments with limited sales data.
Adjustment for time

A useful tool for determining ratio trends is a scatter diagram. (See example on page 6-7.) A common method of graphing is to use the ratio of sales price to real market value against the date of sale. Using this inverse of the conventional sales ratio is beneficial because it makes the graph more readable for the user. An upward trend in the ratios tends to indicate inflation, while a downward trend indicates deflation.

A useful adjunct to this analysis is regression analysis, which helps to quantify the rate of change. Some statistical computer programs provide a curvilinear regression analysis facility to better recognize trends by period within a year, such as: monthly, quarterly, semi-annually, or in multiples of years, annually, bi-annually, etc.

Methods of change adjustment

Three methods for change adjustment are:
I. Ratio trend analysis.
   • Adjusting individual sales.
   • Adjusting the selected ratio.
II. Regression analysis.
   • Linear.
   • Curvilinear.
III. Double sales analysis.

I. Ratio trend analysis

Adjusting individual sales

First, a change adjustment expressed as a percentage needs to be established. Depending upon the amount of data available, an adjustment can be established by month or by quarter. The change adjustment can be determined countywide by property class or by market area by property class.

A graph is an excellent analysis tool to display your data, providing you with a visual projection of the data and the market-related conditions. The Trend Line Chart on page 6-8 is an example that has been created for the purpose of this illustration. The graph will be a representation of the increase of 1 percent per month change adjustment mentioned in the following paragraphs.

To compute this adjustment:

1. Plot the ratios by month for the 12-month period.
2. A trend line would be helpful to easily reveal your year-end ratio conclusion.
3. As established in the graph, the year-end ratio conclusion of 89 percent indicates a value increase over the 12-month period of 11 percent.
4. The 89 percent will need to be converted into an adjustment by dividing 89 percent into 100 percent, which will equal to 1.12359 or 12 percent per year or 1 percent per month.

Once a change trend has been established, the percentage per month or quarter can be applied to each sale. Each sale should be trended to the target assessment date of January 1.

For ease of computation, an increase of 1 percent per month change adjustment is used. In the following example, the month sold is the first month counted.
Adjustment for time

Individual sales adjustment table

<table>
<thead>
<tr>
<th>RMV Jan–01</th>
<th>Sale price</th>
<th>Ratio</th>
<th>Sale date</th>
<th># Months to Jan–02</th>
<th>Change adjustment</th>
<th>Tended sale price</th>
<th>Adjusted ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>$99,980</td>
<td>$118,000</td>
<td>85</td>
<td>Nov</td>
<td>2</td>
<td>1.02</td>
<td>$120,360</td>
<td>83</td>
</tr>
<tr>
<td>$123,640</td>
<td>$145,000</td>
<td>85</td>
<td>Jun</td>
<td>7</td>
<td>1.07</td>
<td>$155,150</td>
<td>80</td>
</tr>
<tr>
<td>$89,090</td>
<td>$89,900</td>
<td>99</td>
<td>Dec</td>
<td>1</td>
<td>1.01</td>
<td>$90,799</td>
<td>98</td>
</tr>
<tr>
<td>$116,730</td>
<td>$115,500</td>
<td>101</td>
<td>Aug</td>
<td>5</td>
<td>1.05</td>
<td>$121,275</td>
<td>96</td>
</tr>
<tr>
<td>$120,710</td>
<td>$118,000</td>
<td>102</td>
<td>May</td>
<td>8</td>
<td>1.08</td>
<td>$127,440</td>
<td>95</td>
</tr>
<tr>
<td>$97,420</td>
<td>$95,000</td>
<td>103</td>
<td>Apr</td>
<td>9</td>
<td>1.09</td>
<td>$103,550</td>
<td>94</td>
</tr>
<tr>
<td>$250,720</td>
<td>$235,000</td>
<td>107</td>
<td>May</td>
<td>8</td>
<td>1.08</td>
<td>$253,800</td>
<td>99</td>
</tr>
<tr>
<td>$140,520</td>
<td>$130,500</td>
<td>108</td>
<td>Jul</td>
<td>6</td>
<td>1.06</td>
<td>$138,330</td>
<td>102</td>
</tr>
<tr>
<td>$172,540</td>
<td>$159,900</td>
<td>108</td>
<td>Dec</td>
<td>1</td>
<td>1.01</td>
<td>$161,499</td>
<td>107</td>
</tr>
<tr>
<td>$111,120</td>
<td>$100,450</td>
<td>111</td>
<td>Jan</td>
<td>12</td>
<td>1.12</td>
<td>$112,504</td>
<td>99</td>
</tr>
</tbody>
</table>

$1,322,470  $1,307,250  $1,384,707  952

Central tendencies before adjustment  Central tendencies after adjustment

|          |          |          |          |          |
| Mean     | 101      | Mean     | 95       |
| Median   | 102      | Median   | 97       |
| Weighted Mean | 101 | Weighted Mean | 96 |

Note: The after-change adjustment ratios are not in ascending order. They will need to be re-sorted to provide a new array.

Adjusting the selected ratio

With this approach, the selected ratios of the same property class (types) in various market areas may have the change adjustment factor applied to achieve the proper ratio for the next January 1 assessment date. Sufficient sales are needed for this method to be useful.

To compute this adjustment:

1. Graph the ratios by month of sale or by quarter if enough data is not available by month. A trend-line needs to be computed from this graph. See the following Trend Line Chart.

- Determine the central tendency of the sales sample by month.

2. Determine the mid-point of the sales year. The mid-point is the ratio that most accurately represents the majority of the sales activity during the ratio year. This is not necessarily the middle of the year. An example of how to determine the mid-point follows.

Mid-point ratio table

<table>
<thead>
<tr>
<th>Ratio indication for the month</th>
<th>Number of sales per month</th>
<th>Cumulative sales</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>99</td>
<td>195</td>
</tr>
<tr>
<td>February</td>
<td>97</td>
<td>176</td>
</tr>
<tr>
<td>March</td>
<td>97</td>
<td>215</td>
</tr>
<tr>
<td>April</td>
<td>96</td>
<td>174</td>
</tr>
<tr>
<td>May</td>
<td>94</td>
<td>298</td>
</tr>
<tr>
<td>June</td>
<td>95</td>
<td>316</td>
</tr>
<tr>
<td>July</td>
<td>93</td>
<td>293</td>
</tr>
<tr>
<td>August</td>
<td>93</td>
<td>305</td>
</tr>
<tr>
<td>September</td>
<td>91</td>
<td>274</td>
</tr>
<tr>
<td>October</td>
<td>92</td>
<td>303</td>
</tr>
<tr>
<td>November</td>
<td>91</td>
<td>265</td>
</tr>
<tr>
<td>December</td>
<td>91</td>
<td>236</td>
</tr>
</tbody>
</table>

* July represents the middle of the sales year in this example.

Using this example: To find the simple average, divide total sales (3,050) by 2.

\[
3,050 \div 2 = 1,525
\]
Adjustment for time

To find the mid-point ratio, find the closest number (and corresponding month) in the array.

3. Compute the percent change from the mid-point ratio on the trend line to the next January 1 ratio on the trend line. For example, using the trend line per the following graphs (see midpoint ratio chart on page 6-9):

- The central tendency on the trend line is the July ratio (93) and the next January 1 ratio (91).
- To compute the percent change from the mid-point on the trend line to next January 1, calculate as follows:
  1. January 1 trend line ratio (91) minus mid-point trend line ratio (93) divided by the mid-point trend line ratio (93) equals the trend.
     
     \[
     \frac{91 - 93}{93} = -0.022 \text{ or } -2\%
     \]
  2. Subtract the -2 percent from 100 percent to get the change trend adjustment factor (multiplier) of 0.98 or 98 percent.
     
     If positive adjustment (number) add to 100
     If negative number, subtract from 100, as a reciprocal.

3. Example: Using the selected ratio from individual sales adjustment table "Central Tendency Before Adjustment," multiply by 98 percent or 0.98 to reflect the change to January 1.

4. For this example, use the “Central Tendency Before Adjustment” table’s mean ratio of 101 percent as the selected ratio.

5. 101 x 0.98 (change adjustment factor) = 99 (change adjusted selected ratio)

Note: 99 is in line with the Central Tendencies when monthly change adjustments were applied to each sale in the Individual Sales Adjustment Table.

If sales data are insufficient to establish a trend, use the selected ratio from the array for the January 1 trended ratio.

II. Regression analysis

Regression is a technique that tries to define the relationship between the two variables time and change. It is an attempt to express the relationship between the variables as a mathematical formula. Once the formula is determined, other convergences of time and change can be predicted. Also, the rate of change over time can be estimated. The trick is not only determining the type of relationship that best fits the data, but determining how well the relationship fits the data.

Linear regression

An effective method of adjusting for change involves linear regression. It must be emphasized that this method assumes that property values change by a constant percentage each month. This method may be viable for a relatively short period of time, such as a ratio year. Over longer periods of time, or in a rapidly changing or unusual market, it may be necessary to use nonlinear adjustment factors.

Note: Some software programs use the mean to make linear regression calculations.

Procedures for applying linear regression for ratio trend lines:

1. For the population sales array, develop central tendencies per time period (month). If the sales are scarce, determine your central tendency by quarter (three-month period).

2. On a graph, plot the central tendency by time period (month). Let the X-axis be the period and the Y-axis be the central tendency indication.

3. Connect the dots of the central tendencies with the “best fit” straight line.

4. Using linear regression, determine the slope of the line. The slope of the straight line is the trend of the ratio by the time period as determined in Step 1.

Briefly stated:

If the relationship between two variables (eg., time and sales price) can be expressed as a straight line, the relationship is deemed “linear.”

According to Webster’s, “regression” is defined as “a functional relationship between two or more correlated variables that is often empirically determined from data and is used especially to predict values of one variable when given values of the other(s).”

If we put the two words together, it means that in a straight-line relationship between two variables, we can predict one variable if the other is known. Applying this to the trend of the ratio, we are saying that if we know the time period, we can predict the central tendency by either interpolating within the line or extrapolating from the line.
The formula for a straight line is: \( y = ax + b \)

In the above formula:
1. \( y \) is the dependent variable. The value of \( y \) depends on the value of \( x \).
2. \( x \) is the independent variable. The above formula solves for \( y \), not \( x \).
3. \( b \) is the \( y \) intercept. If \( x = 0 \), \( y \) will be that value.
4. \( a \) is the slope of the line. The slope of the line is also the rate of change of the dependent variable for the indicated unit of \( x \).

Using the above formula, we can solve for \( y \) if we know \( x \); or in our case, we can solve for the central tendency if we know the time period. However, we really aren’t interested in solving for \( y \). What we want to know is the rate of change in \( y \) for every unit of \( x \). In this case, the slope of the line \( a \) indicates the rate of change in the central tendency, per period.

The inverse relationship exists between the ratios and the sale prices. A downward slope would mean that the sale prices are increasing over time. An upward slope would mean that the sale prices are decreasing over time.

Spreadsheet programs are available to plot regression lines and slope formulas.

III. Double sale/comparable sales analysis

Another method of determining a change adjustment is by analyzing:

- Properties that have sold twice during a relatively short period of time. Both sales of the same property need to be analyzed to ascertain that they are representative of open market activity and usable for the ratio study (same as assessed).

- Sales of comparable properties. These are properties, not the same, but very similar in all property characteristics (class, age, condition, etc.).

The percentage change is determined by doing the following:
1. Subtract the first sale price \( (SP1) \) from the second sale price \( (SP2) \) to determine the dollar difference \( (DD) \) between the first and second sale.
2. Divide the dollar difference \( (DD) \) by the first sale price \( (SP1) \) to determine the overall percentage change \( (OPC) \).
3. Divide the overall percentage change \( (OPC) \) by the time span \( (TS) \) to determine the monthly percentage change \( (MPC) \).

When computed, this change adjustment can be applied to other sales occurring in the same time period. Following is an example using both a double sale property and sales comparison to determine the monthly change in value.

Assume the following:
1. The assessment date is January 1; the sales year is the prior January 1 through December 31.
2. For the current sales year, property class 4-0-0 only had five sales county wide.
3. During the previous sales year, there were seven confirmed sales that have been adjusted to January 1.

<table>
<thead>
<tr>
<th>Sale date</th>
<th>Sale Price (SP)</th>
<th>Time Span (TS)</th>
<th>Dollar Difference (DD)</th>
<th>Overall Percent Change (OPC)</th>
<th>Monthly Percent Change (MPC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Double sale</td>
<td>5/98</td>
<td>$49,500 (1)</td>
<td>7 mo.</td>
<td>$4,100</td>
<td>8.28</td>
</tr>
<tr>
<td>12/98</td>
<td>$53,600 (2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sales of comparable properties</td>
<td>5/97</td>
<td>$68,900 (1)</td>
<td>11 mo.</td>
<td>$10,600</td>
<td>15.38</td>
</tr>
<tr>
<td>4/98</td>
<td>$79,500 (2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
This analysis indicates the prior year sales could be adjusted approximately 1 percent per month to make them comparable to current year sales.

It may be necessary to identify comparable properties that have sold at different points in time and adjust one property to the other for differences in physical characteristics. This method is similar to the method described above, but involves a preliminary step of adjusting the sales price on one property so that both sales prices reflect physically similar properties. The amount of adjustment is determined by a paired sales study or by using the depreciated value of the amenity.

For example, suppose that two homes in a newer tract neighborhood sold within six months of each other. The first sale was for $112,000, and the second sale was for $120,000. The homes are very similar except that the second home has an extra garage space, the depreciated value of which is $2,800; adding the $2,800 to the sales price of the first home yields an adjusted sales price of $114,800. These sales are now ready to be used in an analysis as described above.

Example graphs on page 6-10:
- Linear Trend line from Monthly Ratios.
- Curvilinear Trend line from Monthly Ratios.
- Seasonal Trend line from Monthly Ratios.
Change Trend From January Through December

Scatter, Trend, and Linear Regression Graph
Adjustment for time

Trend line chart

Trend Line Chart

Ratios per Month

MONTHS

120 110 100 90 80 70 60 50 40 30 20 10 0

RATIOS

105 100 90 87 88 89 90 95 95 89 87
Mid-point ratio chart
Adjustment for time

Example graphs

<table>
<thead>
<tr>
<th>Average month</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>99</td>
</tr>
<tr>
<td>2</td>
<td>97</td>
</tr>
<tr>
<td>3</td>
<td>97</td>
</tr>
<tr>
<td>4</td>
<td>96</td>
</tr>
<tr>
<td>5</td>
<td>94</td>
</tr>
<tr>
<td>6</td>
<td>95</td>
</tr>
<tr>
<td>7</td>
<td>93</td>
</tr>
<tr>
<td>8</td>
<td>93</td>
</tr>
<tr>
<td>9</td>
<td>91</td>
</tr>
<tr>
<td>10</td>
<td>92</td>
</tr>
<tr>
<td>11</td>
<td>91</td>
</tr>
<tr>
<td>12</td>
<td>91</td>
</tr>
</tbody>
</table>

**Linear Trend Line From Monthly Ratios**

**Curvilinear Trend Line From Monthly Ratios**

**Seasonal Trend Line**

\[ y = -0.1x + 92.3 \]
Computing the ratio

Central tendencies

Array analysis

To compute a ratio, divide the current certified roll RMV by the sale price or change adjusted sale price, for that sale.

**Example:** Ratio study for January 1, assessment date:
RMV from current certified roll ÷ Change adjusted sale price = Ratio for January 1

$23,000 ÷ $32,960 = .70 or 70%

Once a ratio is computed for each sale, the sales can be arrayed in ascending order of low to high ratio.

**Table 1**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$23,000</td>
<td>$32,000</td>
<td>72</td>
<td>Oct</td>
<td>$32,960</td>
<td></td>
<td>70</td>
</tr>
<tr>
<td>2</td>
<td>20,000</td>
<td>25,000</td>
<td>80</td>
<td>Jun</td>
<td>26,750</td>
<td></td>
<td>75</td>
</tr>
<tr>
<td>3</td>
<td>32,000</td>
<td>36,500</td>
<td>88</td>
<td>Mar</td>
<td>40,150</td>
<td></td>
<td>80</td>
</tr>
<tr>
<td>4</td>
<td>40,000</td>
<td>45,000</td>
<td>89</td>
<td>Apr</td>
<td>49,050</td>
<td></td>
<td>82</td>
</tr>
<tr>
<td>5</td>
<td>33,000</td>
<td>34,950</td>
<td>94</td>
<td>May</td>
<td>37,746</td>
<td></td>
<td>87</td>
</tr>
<tr>
<td>6</td>
<td>25,500</td>
<td>27,000</td>
<td>94</td>
<td>Aug</td>
<td>28,350</td>
<td></td>
<td>90</td>
</tr>
<tr>
<td>7</td>
<td>42,000</td>
<td>43,500</td>
<td>97</td>
<td>Jun</td>
<td>46,545</td>
<td></td>
<td>90</td>
</tr>
<tr>
<td>8</td>
<td>36,100</td>
<td>36,500</td>
<td>99</td>
<td>Nov</td>
<td>37,230</td>
<td></td>
<td>97</td>
</tr>
<tr>
<td>9</td>
<td>28,000</td>
<td>25,000</td>
<td>112</td>
<td>Jul</td>
<td>26,500</td>
<td></td>
<td>106</td>
</tr>
<tr>
<td>10</td>
<td>42,000</td>
<td>34,000</td>
<td>124</td>
<td>Sept</td>
<td>35,360</td>
<td></td>
<td>119</td>
</tr>
</tbody>
</table>

$321,600

Mean 90
Median 89
Weighted Mean 89

$360,641 896

**Sampling**

Statistical measures rely upon samples that are drawn at random. Because sales are not necessarily random, the sales need to represent the characteristics of the property class and area from which they are drawn.

**Example:** An appraisal valuation area is predominately of mixed age and class. Most of the sales are newer, average quality houses. Because sales are of newer houses, this sample would not represent the appraisal valuation area and additional analysis may be necessary.

**Frequency distribution**

A frequency distribution shows the number of ratios falling within specified intervals. This can be graphed as a histogram, which shows the pattern of the distribution. To construct a frequency distribution, array the ratios, select intervals in which to group the ratios, and then count the number of ratios in each interval.
A histogram is a bar chart, or graph, of a frequency distribution of ratios in the sample. It is the pattern of the distribution that can be used to determine which measure of central tendency to use. The highest bar represents the most frequent ratio within the interval. Many statistical measures rely on normal distributions, illustrated by a bell–shaped curve to indicate uniformity (see Figure 1).

If the curve is skewed in one direction or the other (see Figure 2), this may mean a statistic such as the geometric mean should be used. If there is more than one curve, the sales array may be indicating that there is a need to further separate (stratify) the sales data into two or more groups i.e., different ages or classes of houses, lot sizes, amenities as view/non-view, etc. for additional analyses.

Since the sales array is a representation of the total population or market area, multiple market influences can be occurring at the same time. By stratifying the original sales array further, a more accurate picture is derived and adjustments can be applied more accurately to those properties being affected in the market.
Measuring real market value (RMV) level

Central tendencies are the statistical reference for the measurements used in determining RMV levels. These central tendencies are derived from the arrayed ratios on the sales listings. The central tendency is based on the available sales data, and is computed from ratios found by dividing each RMV on the current certified roll by the sale price of that property. The goal is to select one central tendency that best represents the RMV level for the area that you are measuring. Ratios can be expressed in decimal or percent form. For ease of reading in this manual, ratios will be expressed as whole numbers in most instances.

There are three required calculated tests of RMV level: the median, arithmetic mean, and weighted mean, also known as measures of central tendency. Two other
optional tests are also recognized as the **mode** and **geometric mean**.

The purpose of each measure is to find out whether differences between RMV and sales prices are random individual events or are systematic, resulting in low or high overall levels of RMV. The different tests are used because each test identifies a different type of distortion or bias. Those effects are then minimized by reviewing the results. The following identifies the tests, symbols, and formulas.

### Central tendencies (ratio indications)

The measures of central tendency are the median, arithmetic mean, weighted mean, geometric mean, and mode. They are calculated using the sales that constitute the sales sample. The results are only point estimates or statistics related to the sample. Additional tests of the reliability of these statistics are necessary to draw inferences about the population of unsold and sold properties that the samples represent. Each measure has its advantages and disadvantages, and must be carefully analyzed to determine the central tendency ratio that is most typical of the property class and market area.

The following array demonstrates the measures of central tendency.

#### Table 2

**Prior year real market value sale information**

<table>
<thead>
<tr>
<th>Appraisal area</th>
<th>Property class</th>
<th>Land value</th>
<th>Imp. value</th>
<th>Total value</th>
<th>Sale price</th>
<th>Sale no.</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>101</td>
<td>$24,000</td>
<td>$101,500</td>
<td>$125,500</td>
<td>$150,000</td>
<td>1</td>
<td>84</td>
</tr>
<tr>
<td>1</td>
<td>101</td>
<td>12,000</td>
<td>168,000</td>
<td>180,000</td>
<td>200,000</td>
<td>2</td>
<td>90</td>
</tr>
<tr>
<td>1</td>
<td>101</td>
<td>9,000</td>
<td>51,000</td>
<td>60,000</td>
<td>62,500</td>
<td>3</td>
<td>96</td>
</tr>
<tr>
<td>1</td>
<td>101</td>
<td>9,000</td>
<td>51,500</td>
<td>60,500</td>
<td>63,000</td>
<td>4</td>
<td>96</td>
</tr>
<tr>
<td>1</td>
<td>101</td>
<td>9,000</td>
<td>52,000</td>
<td>61,000</td>
<td>63,500</td>
<td>5</td>
<td>96</td>
</tr>
<tr>
<td>1</td>
<td>101</td>
<td>9,000</td>
<td>59,800</td>
<td>68,800</td>
<td>70,000</td>
<td>6</td>
<td>98</td>
</tr>
<tr>
<td>1</td>
<td>101</td>
<td>9,000</td>
<td>60,600</td>
<td>69,600</td>
<td>70,000</td>
<td>7</td>
<td>99</td>
</tr>
<tr>
<td>1</td>
<td>101</td>
<td>12,000</td>
<td>49,500</td>
<td>61,500</td>
<td>60,000</td>
<td>8</td>
<td>103</td>
</tr>
<tr>
<td>1</td>
<td>101</td>
<td>7,500</td>
<td>34,450</td>
<td>41,950</td>
<td>35,000</td>
<td>9</td>
<td>120</td>
</tr>
<tr>
<td>1</td>
<td>101</td>
<td>7,500</td>
<td>31,750</td>
<td>39,250</td>
<td>30,000</td>
<td>10</td>
<td>131</td>
</tr>
<tr>
<td><strong>Totals:</strong></td>
<td></td>
<td><strong>$768,100</strong></td>
<td><strong>$804,000</strong></td>
<td><strong>1,013</strong></td>
<td><strong>Mean</strong></td>
<td><strong>101</strong></td>
<td><strong>Median</strong></td>
</tr>
</tbody>
</table>

1. The mean is distorted upward by the high ratio at the end of the array.
2. The weighted mean is distorted by the two large value sales at the lower end of the array.
3. The median is the best indicator because it is not affected by either the high ratio or large value sales.
4. Sales 1, 2, 9, and 10 might indicate further review is needed because of their extreme values at either end of the array.

### Median

**Central tendency**

**Measure of real market value level**

The **median**, or middle ratio of an array, is influenced only by the position of the ratios in the array, not by their values. Extreme ratios do not affect the median.
The median is reliable when the array contains a proper distribution of ratios near the center of its range.

The median will **not** be representative of central tendency when:

- The array contains few ratios with a wide range, or
- Where many ratios congregate at both the upper and lower ends of the array, leaving few ratios in the center of the array range.

The mathematical formula for the median is:

\[ n + 1 \div 2 \]

(n) equals the number of sales in the array.

To compute the median central tendency using Table 3, first determine whether your sales array has an odd or even total number of sales.

**Odd number of sales:**

1. To determine the middle sale in the array, add 1 to the total number of sales and divide the sum by 2.
2. Locate the corresponding ratio for this sale.
   
   \[ 9 + 1 \div 2 = 5 \text{—Sale No. 5 is the middle sale} \]

   The corresponding ratio for Sale No. 5 is (93)

**Even number of sales:**

1. To determine the middle sale in the array, add 1 to the total number of sales and divide the sum by 2. The median sale falls between the two middle sales.
2. Locate the corresponding ratios for these sales, add them together, and divide by 2.
   
   Assume the following: 10 sales in the array
   
   Ratio for Sale No. 5 = 93
   
   Ratio for Sale No. 6 = 93

\[ 10 + 1 \div 2 = 5.5 \text{ middle of array} \]

\[ 93 + 93 \div 2 = 186 \div 2 = 93 \]

(Median of 93 = Ratio halfway between 5 and 6)

**Array analysis hints**

When the array contains extreme ratios those sales need to be checked for:

- Correct property classification;
- Validity of market or value area;
- Data entry errors;
- Possible stratification of the data;
- Possibility of invalid sales; and
- Current year’s RMVs.

**Of equal importance is the need to:**

- Reexamine deeds for accuracy and completeness;
- Reconfirm sales; and
- Verify field review of sales with extreme ratios.

See Chapter 5 for more details on sales verification process.

After the median ratio has been calculated indicating a RMV level, the next step is to measure the uniformity of the RMV by calculating the average absolute deviation and the coefficient of dispersion from the median. Uniformity of assessment indicates the quality and equity levels of the RMVs on the roll.

**Average absolute deviation (AAD)**

**Uniformity measure**

The average absolute deviation (AAD) measures the average spread, or number of point differences between each ratio and the median ratio. The term **absolute** indicates absolute value: that is, the “plus” or “minus” direction of spread—whether above or below a measure of central tendency—is unimportant. The degree, or magnitude, of the differences is the significant aspect.

Mathematically, the AAD can be written as:

\[ \text{Average absolute deviation} = \frac{\Sigma |X_i - \bar{X}_m|}{n} \]

See below for steps to calculate this formula.

**Note:** It is important to know how your computer application calculates the **average absolute deviation**. The **accepted central tendency** for this calculation for property tax ratio study analysis in Oregon is the **median**. If you discover your computer application is calculating the AAD around the **arithmetic mean**, you will have to make that correction.

The average absolute deviation is computed as follows:

1. Select the median ratio for comparison.

**Table 3**

<table>
<thead>
<tr>
<th>Appraisal area</th>
<th>Property class</th>
<th>Certified roll real market value</th>
<th>Sale price</th>
<th>Sale number</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>1-0-0</td>
<td>$1,830</td>
<td>$3,000</td>
<td>1</td>
<td>61</td>
</tr>
<tr>
<td>3</td>
<td>1-0-0</td>
<td>8,000</td>
<td>9,800</td>
<td>2</td>
<td>82</td>
</tr>
<tr>
<td>3</td>
<td>1-0-0</td>
<td>7,500</td>
<td>8,500</td>
<td>3</td>
<td>88</td>
</tr>
<tr>
<td>3</td>
<td>1-0-0</td>
<td>7,000</td>
<td>7,500</td>
<td>4</td>
<td>93</td>
</tr>
<tr>
<td>3</td>
<td>1-0-0</td>
<td>7,000</td>
<td>7,500</td>
<td>5</td>
<td>93</td>
</tr>
<tr>
<td>3</td>
<td>1-0-0</td>
<td>11,000</td>
<td>11,830</td>
<td>6</td>
<td>93</td>
</tr>
<tr>
<td>3</td>
<td>1-0-0</td>
<td>10,000</td>
<td>10,000</td>
<td>7</td>
<td>100</td>
</tr>
<tr>
<td>3</td>
<td>1-0-0</td>
<td>8,000</td>
<td>7,000</td>
<td>8</td>
<td>114</td>
</tr>
<tr>
<td>3</td>
<td>1-0-0</td>
<td>8,000</td>
<td>6,150</td>
<td>9</td>
<td>130</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>$68,330</td>
<td>$71,280</td>
<td>854</td>
<td></td>
</tr>
</tbody>
</table>
Statistical analysis

2. Subtract the individual ratio from the median. If the individual ratio is larger than the selected ratio, the difference should always be shown as a positive number. You are concerned only with the total amount of deviation, rather than the plus or minus factor.

3. Add the differences and divide by the number of sales.

Example: Using Table 3, median indication of 93

<table>
<thead>
<tr>
<th>Number</th>
<th>Ratio</th>
<th>Median ratio</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>61</td>
<td>93</td>
<td>32</td>
</tr>
<tr>
<td>2</td>
<td>82</td>
<td>93</td>
<td>11</td>
</tr>
<tr>
<td>3</td>
<td>88</td>
<td>93</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>93</td>
<td>93</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>93</td>
<td>93</td>
<td>0</td>
</tr>
<tr>
<td>6</td>
<td>93</td>
<td>93</td>
<td>0</td>
</tr>
<tr>
<td>7</td>
<td>100</td>
<td>93</td>
<td>7</td>
</tr>
<tr>
<td>8</td>
<td>114</td>
<td>93</td>
<td>21</td>
</tr>
<tr>
<td>9</td>
<td>130</td>
<td>93</td>
<td>37</td>
</tr>
</tbody>
</table>

\[ \frac{113}{9} = 13 \]

Median = 93  Average absolute deviation = 13

The higher the AAD, the greater the lack of RMV uniformity.

When the AAD is expressed as a percentage of the median, it is called the Coefficient of Dispersion (COD), and its usefulness is expanded.

Coefficient of dispersion (COD)

Uniformity measure

The COD is the average absolute deviation converted to a percentage of the median. This conversion is necessary to establish a relationship between the average absolute deviation and the median ratio. Using the average absolute deviation, as calculated above, the COD is calculated mathematically as follows:

\[ \text{COD} = \frac{\text{AAD}}{\bar{X}_{\text{Median}}} \times 100 \]

1. Divide the AAD (of the median ratio) by the median ratio.
2. Multiply this figure by 100 to convert it to a percentage.

Using Table 3:

\[ \text{COD} = (\text{AAD} + \bar{X}_{\text{Median}}) \times 100 \]

\[ 13 \div 93 = .14 \text{ or } .14 \times 100 = 14 \text{ COD (rounded)} \]

This computation is important in measuring uniformity of RMV. The COD shows how much the values in a given array vary from the central tendency (the median). The lower the percentage of variability, the more the values are clustering to the center, and the greater the uniformity within the property class or sample.

Evaluation of coefficients depends on the property class. Coefficients between 10 and 20 generally indicate acceptable assessment equity. Lower coefficients are usually found where most of the sales are located in homogeneous residential areas or recently revalued properties. Care should be taken to ensure that low coefficients are the result of good appraisal valuation practices.

For single-family residences, coefficients should generally be 15 or less, and for newer and fairly homogeneous areas, 10 or less.

Income-producing properties should have coefficients of 20 or less, and in larger, urban jurisdictions, 15 or less.

Vacant land and other property classes should have coefficients of 20 or less.

Note: The above guidelines can be adversely affected by heterogeneous areas.

COD standards

The following table is from the Oregon Administrative Rule (OAR 150-308.234). This outlines the maximum COD standards, by property class, established by assessors and department staff to measure the results of the counties’ valuation programs:

<table>
<thead>
<tr>
<th>Type of property (Property class)</th>
<th>Maximum COD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vacant land (100, 400)</td>
<td>20</td>
</tr>
<tr>
<td>Real &amp; personal manufactured</td>
<td>25</td>
</tr>
<tr>
<td>structures/mobile homes</td>
<td></td>
</tr>
<tr>
<td>Urban residential (101)</td>
<td></td>
</tr>
<tr>
<td>Homogeneous</td>
<td>10</td>
</tr>
<tr>
<td>Nonhomogeneous</td>
<td>15</td>
</tr>
<tr>
<td>Rural improved (101, 401)</td>
<td>20</td>
</tr>
<tr>
<td>Apartments (701)</td>
<td>12</td>
</tr>
<tr>
<td>Other income (201)</td>
<td></td>
</tr>
<tr>
<td>Large urban</td>
<td>15</td>
</tr>
<tr>
<td>Smaller rural</td>
<td>20</td>
</tr>
</tbody>
</table>

Arithmetic mean

Central tendency

Measure of real market value level

Often referred to as the mean, the arithmetic mean is the simple average of the individual ratios in the sales array.
The mathematical formula for the arithmetic mean is expressed:

\[ \bar{X} = \frac{\text{Total Ratios} + \text{number of sales in array}}{\text{number of sales in array}} \]

To compute the mean using Table 4:
1. Total (sum) all the ratios = 784
2. Divide the sum by the number of sales . . . 784 ÷ 8 = 98

**Table 4**

<table>
<thead>
<tr>
<th>Appraisal/valuation area</th>
<th>Class</th>
<th>Land value</th>
<th>Imp. value</th>
<th>Property value</th>
<th>Total price</th>
<th>Sale no.</th>
<th>Sale ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>4-0-1</td>
<td>$82,640</td>
<td>$78,010</td>
<td>$160,650</td>
<td>$200,000</td>
<td>1</td>
<td>80</td>
</tr>
<tr>
<td>3</td>
<td>4-0-1</td>
<td>17,450</td>
<td>5,490</td>
<td>22,940</td>
<td>26,000</td>
<td>2</td>
<td>88</td>
</tr>
<tr>
<td>3</td>
<td>4-0-1</td>
<td>15,310</td>
<td>25,200</td>
<td>40,510</td>
<td>45,000</td>
<td>4</td>
<td>90</td>
</tr>
<tr>
<td>3</td>
<td>4-0-1</td>
<td>28,580</td>
<td>1,470</td>
<td>30,050</td>
<td>30,000</td>
<td>5</td>
<td>100</td>
</tr>
<tr>
<td>3</td>
<td>4-0-1</td>
<td>13,320</td>
<td>14,580</td>
<td>27,900</td>
<td>28,000</td>
<td>6</td>
<td>100</td>
</tr>
<tr>
<td>3</td>
<td>4-0-1</td>
<td>22,360</td>
<td>22,790</td>
<td>45,150</td>
<td>40,000</td>
<td>7</td>
<td>113</td>
</tr>
<tr>
<td>3</td>
<td>4-0-1</td>
<td>22,670</td>
<td>40,180</td>
<td>62,850</td>
<td>50,600</td>
<td>8</td>
<td>124</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>$483,360</td>
<td>$524,100</td>
<td>784</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In this example, the mean is the best ratio indicator because it represents the range of ratios and is not distorted by extremes at either end.

If the array does not contain extremely high or low ratios, the mean is an accurate measurement. However, it is easily distorted if there are extreme ratios in the array.

The array should be reanalyzed to determine what effects such ratios may have on the arithmetic mean. This may indicate that one of the other measures of central tendency would be more indicative of your market.

**Array analysis hints**

When the array contains extreme ratios those sales need to be checked for:

- Correct property classification;
- Validity of market or value area;
- Data entry errors;
- Possible stratification of the data;
- Possibility of invalid sales; and
- Current year’s RMVs.

Of equal importance is the need to:

- Reexamine deeds for accuracy and completeness;
- Reconfirm sales; and
- Verify field review of sales with extreme ratios.

See Chapter 5 for more details on sales verification process.

**Standard deviation**

**Uniformity measure**

The standard deviation is a statistical measure of the spread or distance of ratios from the mean in the array.

Mathematically, the standard deviation can be written as follows:

\[ s = \sqrt{\frac{\sum (X_i - \bar{X}_\text{mean})^2}{n - 1}} \]

Where \( s \) is the standard deviation, \( \sum \) stands for “sum of,” \( X_i \) represents each ratio, \( \bar{X}_\text{mean} \) is the mean ratio, and \( n \) is the number of ratios.

To compute the standard deviation:
1. Subtract the mean from each ratio.
2. Square the resulting differences—squared numbers have a positive sign.
3. Sum the squared differences.
4. Divide by the number of ratios minus one.
5. Compute the square root of the result.

Using Table 4, the standard deviation is computed as follows:

<table>
<thead>
<tr>
<th>Sale number</th>
<th>Ratio</th>
<th>Mean ratio</th>
<th>Mean difference</th>
<th>Squared</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>80</td>
<td>98</td>
<td>-18</td>
<td>324</td>
</tr>
<tr>
<td>2</td>
<td>88</td>
<td>98</td>
<td>-10</td>
<td>100</td>
</tr>
<tr>
<td>3</td>
<td>89</td>
<td>98</td>
<td>-9</td>
<td>81</td>
</tr>
<tr>
<td>4</td>
<td>90</td>
<td>98</td>
<td>-8</td>
<td>64</td>
</tr>
<tr>
<td>5</td>
<td>100</td>
<td>98</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>6</td>
<td>100</td>
<td>98</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>7</td>
<td>113</td>
<td>98</td>
<td>15</td>
<td>225</td>
</tr>
<tr>
<td>8</td>
<td>124</td>
<td>98</td>
<td>26</td>
<td>676</td>
</tr>
</tbody>
</table>

1,478 ÷ 7 = 211
Square root of 211 = 14.5 or 15

The interpretation of the standard deviation needs to take into account whether the data can be regarded as
normally distributed, and whether the sample is representative. Normal distributions are seen as a symmetrical bell curve when plotted graphically. The definition of normal distributions implies the following:

1. 68 percent +/– of all sales fall within one standard deviation of the mean.
2. 95 percent +/– of all sales fall within two standard deviations of the mean.
3. 99 percent +/– of all sales fall within three standard deviations of the mean.

The following is an example of a normal distribution (using Table 4):

<table>
<thead>
<tr>
<th>Mean</th>
<th>Standard deviation</th>
<th>Number of sales</th>
</tr>
</thead>
<tbody>
<tr>
<td>98</td>
<td>15</td>
<td>8</td>
</tr>
</tbody>
</table>

If this array of sales is normally distributed:

- Approximately 68 percent of sales or 5+ will lie between the ratios 83 and 113.
- Approximately 95 percent of sales or 7+ will lie between 68 and 128.
- Approximately 99 percent of sales or 8 will lie between 53 and 143.

Another illustration of the proportion that can be predicted from the standard deviation is shown in the following graph.
**Coefficient of variation (COV)**

**Uniformity measure**

The coefficient of variation is a measurement of the differences between the ratios in the sample and the mean ratio expressed as a percentage of the mean ratio. This is an expression of the standard deviation in terms relative to the mean ratio.

Mathematically the formula for determining the coefficient of variation (COV) is:

\[
COV = \frac{s}{\bar{X}} \times 100
\]

\[
S = \text{standard deviation} \div \bar{X} = \text{COV}
\]

The COV is computed as follows:

1. Divide the standard deviation of the mean ratio by the mean.
2. Multiply this figure by 100 in order to convert it to a percentage.

Using the standard deviation arrived at from Table 4, the COV would be:

\[
15 \div 98 = 0.153
\]

\[
0.153 \times 100 = 15
\]

**Weighted mean**

**Central tendency**

**Measure of real market value level**

The weighted mean is a central tendency derived from the total current certified roll RMVs of the sales and total of the sale prices in the entire array.

Mathematically, the formula for the weighted mean is:

\[
X_{\text{Wt. Mean}} = \frac{\text{Total RMVs} \div \text{Total Sale Prices}}{\text{Total Sale Prices}} \times 100
\]

To compute the weighted mean (from Table 5):

1. Add the current certified roll year real market values in the sales array: $2,786,390.
2. Add the sale prices of the sales in the array: $2,809,610.
3. Divide the total RMV by the total sale prices.

Weighted mean from Table 5 = $2,786,390 ÷ $2,809,610 = 99

**Table 5**

**Current certified roll market value sale information**

<table>
<thead>
<tr>
<th>Appraisal/valuation area</th>
<th>Property class</th>
<th>Land value</th>
<th>Imp. value</th>
<th>Total value</th>
<th>Sale price</th>
<th>Sale no.</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>7-0-1</td>
<td>$120,850</td>
<td>$2,540</td>
<td>$123,390</td>
<td>$210,000</td>
<td>1</td>
<td>59</td>
</tr>
<tr>
<td>2</td>
<td>7-0-1</td>
<td>52,030</td>
<td>53,550</td>
<td>105,580</td>
<td>135,000</td>
<td>2</td>
<td>78</td>
</tr>
<tr>
<td>5</td>
<td>7-0-1</td>
<td>15,500</td>
<td>38,840</td>
<td>54,340</td>
<td>68,200</td>
<td>3</td>
<td>80</td>
</tr>
<tr>
<td>2</td>
<td>7-0-1</td>
<td>60,120</td>
<td>161,220</td>
<td>221,340</td>
<td>275,000</td>
<td>4</td>
<td>80</td>
</tr>
<tr>
<td>2</td>
<td>7-0-1</td>
<td>20,620</td>
<td>89,460</td>
<td>110,080</td>
<td>129,000</td>
<td>5</td>
<td>85</td>
</tr>
<tr>
<td>2</td>
<td>7-0-1</td>
<td>20,760</td>
<td>96,340</td>
<td>117,100</td>
<td>130,060</td>
<td>6</td>
<td>90</td>
</tr>
<tr>
<td>2</td>
<td>7-0-1</td>
<td>20,760</td>
<td>96,430</td>
<td>117,190</td>
<td>130,000</td>
<td>7</td>
<td>90</td>
</tr>
<tr>
<td>2</td>
<td>7-0-1</td>
<td>19,470</td>
<td>97,630</td>
<td>117,100</td>
<td>129,000</td>
<td>8</td>
<td>91</td>
</tr>
<tr>
<td>5</td>
<td>7-0-1</td>
<td>41,690</td>
<td>155,150</td>
<td>196,840</td>
<td>200,850</td>
<td>9</td>
<td>98</td>
</tr>
<tr>
<td>5</td>
<td>7-0-1</td>
<td>74,030</td>
<td>83,530</td>
<td>157,560</td>
<td>159,000</td>
<td>10</td>
<td>99</td>
</tr>
<tr>
<td>4</td>
<td>7-0-1</td>
<td>35,280</td>
<td>177,910</td>
<td>213,190</td>
<td>200,000</td>
<td>11</td>
<td>107</td>
</tr>
<tr>
<td>5</td>
<td>7-0-1</td>
<td>14,500</td>
<td>12,850</td>
<td>27,350</td>
<td>25,000</td>
<td>12</td>
<td>109</td>
</tr>
<tr>
<td>3</td>
<td>7-0-1</td>
<td>35,100</td>
<td>396,860</td>
<td>431,960</td>
<td>382,000</td>
<td>13</td>
<td>113</td>
</tr>
<tr>
<td>3</td>
<td>7-0-1</td>
<td>17,660</td>
<td>78,860</td>
<td>96,520</td>
<td>83,000</td>
<td>14</td>
<td>116</td>
</tr>
<tr>
<td>5</td>
<td>7-0-1</td>
<td>12,500</td>
<td>22,690</td>
<td>35,190</td>
<td>30,000</td>
<td>15</td>
<td>117</td>
</tr>
<tr>
<td>3</td>
<td>7-0-1</td>
<td>18,730</td>
<td>137,500</td>
<td>156,230</td>
<td>164,000</td>
<td>16</td>
<td>120</td>
</tr>
<tr>
<td>3</td>
<td>7-0-1</td>
<td>38,460</td>
<td>160,390</td>
<td>198,850</td>
<td>164,000</td>
<td>17</td>
<td>121</td>
</tr>
<tr>
<td>3</td>
<td>7-0-1</td>
<td>23,860</td>
<td>129,150</td>
<td>153,010</td>
<td>120,000</td>
<td>18</td>
<td>128</td>
</tr>
<tr>
<td>5</td>
<td>7-0-1</td>
<td>31,250</td>
<td>25,110</td>
<td>56,360</td>
<td>40,500</td>
<td>19</td>
<td>139</td>
</tr>
<tr>
<td>2</td>
<td>7-0-1</td>
<td>36,350</td>
<td>60,860</td>
<td>97,210</td>
<td>69,000</td>
<td>20</td>
<td>141</td>
</tr>
</tbody>
</table>

Totals: $2,786,390 $2,809,610 2,062

Weighted mean 99
In this example, the weighted mean takes into consideration the sales with large dollar values that are distributed throughout the sample.

Note that the weighted mean is not influenced by ratios, but on total RMVs. It can be distorted by sale prices where the dollar amounts are not typical of the others in the array. Sales that fall at either end of the array and have much larger dollar amounts than the rest can create a distorted ratio conclusion.

Caution: The weighted mean can be influenced by relatively large dollar amounts on either end of the array.

**Array analysis hints**

When the array contains extreme ratios those sales need to be checked for:

- Correct property classification;
- Validity of market or value area;
- Data entry errors;
- Possible stratification of the data;
- Possibility of invalid sales; and
- Current year’s RMVs.

Of equal importance is the need to:

- Re-examine deeds for accuracy and completeness;
- Re-confirm sales; and
- Verify field review of sales with extreme ratios.

See Chapter 5 for more details on sales verification process.

**Price related differential (PRD)**

**Uniformity measure of vertical equity**

The PRD is used to evaluate whether property appraisals are reasonably equal between high and low valued properties—vertical equity.

There are three aspects of appraisal uniformity:

1. Equity between property groups,
2. Equity within strata, and

The last refers to equality in the treatment of low and high valued properties. An absence of vertical equity is termed assessment regressivity or progressivity.

Assessment regressivity means that when lower valued properties are compared to higher valued properties, the lower valued properties tend to have higher ratios; i.e., their assessed values are higher than their sales prices. Conversely, assessment progressivity means lower value properties have lower ratios (i.e., their assessed values are lower than their sales price) when compared to higher valued properties. Appraisals made for tax purposes, of course, should be neither progressive nor regressive.

The PRD is a statistical way to measure valuation regressivity or progressivity.

It is calculated by dividing the **arithmetic mean** by the **weighted mean**. The mathematical formula is:

\[
PRD = \frac{\bar{X}_{\text{arithmetic mean}}}{\bar{X}_{\text{weighted mean}}}
\]

If the PRD is between .98 and 1.03, the degree of bias or vertical value equity is not considered significant.

The weighted mean implicitly weights each ratio based on its sale price, (i.e., the higher the property’s value, the greater its weight in the analysis), however, the arithmetic mean does not. Since lower PRD numbers suggest valuation progressivity, then higher PRDs suggest regressivity.

Valuations are considered...

- **Regressive**—If low-value properties are overvalued and high–value properties undervalued; i.e., the ratios for low–valued properties are greater than 100 when the ratios for high–valued properties are less than 100. Note, for example, the PRD of 1.09 in the following example.

**Regressive PRD example**

(When the weighted mean is less than the arithmetic mean)

<table>
<thead>
<tr>
<th>RMV</th>
<th>Sale price</th>
<th>Ratio</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>$100,000</td>
<td>$75,000</td>
<td>133</td>
<td>High RMV—Low sale price</td>
</tr>
<tr>
<td>100,000</td>
<td>75,000</td>
<td>133</td>
<td>High RMV—Low sale price</td>
</tr>
<tr>
<td>200,000</td>
<td>200,000</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>200,000</td>
<td>200,000</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>300,000</td>
<td>325,000</td>
<td>92</td>
<td>Low RMV—High sale price</td>
</tr>
<tr>
<td>300,000</td>
<td>325,000</td>
<td>92</td>
<td>Low RMV—High sale price</td>
</tr>
</tbody>
</table>

\[
109 = \text{Arithmetic mean}
\]

\[
100 = \text{Weighted mean}
\]

**Regressive PRD = 1.09** (\(= \frac{\text{Arithmetic Mean}}{\text{Weighted Mean}}\))

- **Progressive**—If high-value properties are overvalued and low-value properties are undervalued; i.e., the ratios for high-valued properties are greater than 100 when the ratios for low-valued properties are less than 100. Note, for example, the PRD of .96 in the following example.
**Progressive PRD example**

(When the weighted mean is greater than the arithmetic mean)

<table>
<thead>
<tr>
<th>RMV</th>
<th>Sale price</th>
<th>Ratio</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>$100,000</td>
<td>$125,000</td>
<td>80</td>
<td>Low RMV—High sale price</td>
</tr>
<tr>
<td>$100,000</td>
<td>$125,000</td>
<td>80</td>
<td>Low RMV—High sale price</td>
</tr>
<tr>
<td>$200,000</td>
<td>$200,000</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>$200,000</td>
<td>$200,000</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>$300,000</td>
<td>$275,000</td>
<td>109</td>
<td>High RMV—Low sale price</td>
</tr>
<tr>
<td>$300,000</td>
<td>$275,000</td>
<td>109</td>
<td>High RMV—Low sale price</td>
</tr>
</tbody>
</table>

96 = Arithmetic Mean
$1,200,000 $1,200,000 100 = Weighted Mean

**Progressive PRD = 0.96 (= arithmetic mean ÷ weighted mean)**

The PRD provides only an indication, not proof, of valuation bias. When sample sizes are small, price-related differentials outside the acceptable range may occur simply because of random sampling error. Further, price-related differentials have a natural upward bias ( regressivity) because of valuation time lags (i.e., changes in market conditions).

Both regressive and progressive price-related differentials can result from misclassifications or systematic problems in valuation schedules or techniques, which emphasize the need for proper stratification of your data.

The PRD is a useful tool in the management of appraisal programs and can be used to direct appraisal staff to areas of concern in specific appraisal areas.

**Other measures of central tendency to consider**

**Geometric mean**

Central tendency

Measure of real market value level

The geometric mean is a measure determined by multiplying all of the ratios in an array sequentially and then taking the “-nth” root (1/20, or 20th in this example) root of this product.

**Example:** Using the data in Table 5 (page 7-9), the geometric mean is:

\[
(59*78*80*85*90*91*98*99*107*109*113*116*117*120*121*128*139*141)^{1/20} = 100.826 \text{ or } 101
\]

**Note:** Asterisk indicates that each ratio number is multiplied by the next sequential number.

The mathematical formula for the geometric mean is expressed:

Geometric mean = \( \sqrt[n]{X_1 \times X_2 \times \ldots X_n} \)

Where: \( X_1 \times X_2 \) represent each ratio in the sample, and \( n \) = the number of ratios in the sample.

The geometric mean offers a measure of the RMV level that, like the median, is not as susceptible to distortion by extreme ratios as the mean and weighted mean. It may be the best measure if the sample has a skewed distribution. Unless every ratio in the sample is identical, the geometric mean will be less than the mean. If the ratios vary widely, the geometric mean may lie considerably below the other measures of central tendency.

Use the following steps to compute the geometric mean:

1. Compute the ratio for each sale in the array;
2. Multiply each ratio by the next ratio in the array (this will be a very large number);
3. Take the \(-nth\) root of the ultimate product, rounded to a whole number, as in the example on the previous page.

**Mode**

Central tendency

**Measure of real market value level**

The mode is the ratio that occurs in the ratio array most frequently. The mode for the data in Table 5 is 80 and 90.

There is not one mode but two for the array because it is bi-modal. This is due to the fact that two ratios occur with equal frequency. The mode is like the median, a location measure.
The goal is to select one of the central tendency indicators (mean, median, weighted mean, geometric mean, or mode) that best represents the RMV level for the area you are measuring. The selected central tendency is strengthened by utilizing the support of another measure of central tendency. This selection may be aided by reviewing historical data, additional studies, overall ratios from the entire county, similar neighborhoods, consistent property classes, additional sales verification information, or information from neighboring counties. This may be especially useful where a small or limited amount of sales exists.

### Summary of RMV level statistics, central tendencies, and uniformity

<table>
<thead>
<tr>
<th>Central tendencies</th>
<th>Advantages</th>
<th>Disadvantages</th>
<th>Recommended when?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median</td>
<td>Unbiased by extreme ratios. Totally positional. Eliminates distortion due to high and low ratios.</td>
<td>Ignores all ratios except for a few ratios around the median indicator.</td>
<td>Arithmetic mean is distorted by extreme ratios at either end of the array.</td>
</tr>
<tr>
<td>Mean</td>
<td>Uses all the data. Basis for uniformity and reliability statistics.</td>
<td>Biased on the high side. Affected by extreme ratios at either end of the array.</td>
<td>The ratios vary with no extreme ratios in the array.</td>
</tr>
<tr>
<td>Weighted mean</td>
<td>Eliminates distortion due to high or low ratios.</td>
<td>Price related weighting distorts toward ratios on higher priced properties.</td>
<td>There are few, if any large real market values and selling prices in the array different from the typical market values and sale prices.</td>
</tr>
<tr>
<td>Geometric mean</td>
<td>Unbiased by extreme high ratios.</td>
<td>Not useful as basis for uniformity and reliability statistics.</td>
<td>The sample has skewed distribution, because this statistic gives less weight to extreme values than the arithmetic mean.</td>
</tr>
<tr>
<td>Mode</td>
<td>Unbiased (totally positional).</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- The goal is to select one of the central tendency indicators (mean, median, weighted mean, geometric mean, or mode) that best represents the RMV level for the area you are measuring. The selected central tendency is strengthened by utilizing the support of another measure of central tendency. This selection may be aided by reviewing historical data, additional studies, overall ratios from the entire county, similar neighborhoods, consistent property classes, additional sales verification information, or information from neighboring counties. This may be especially useful where a small or limited amount of sales exists.

### Additional analysis of central tendencies

#### Validity determination

Sales in the array should be representative of the population. The following is offered as statistical evidence of those findings.

Before tests of reliability are made, validity of the sample data must be established. A test for bias should be conducted to demonstrate that the sample is truly representative of the population. An array of sales without this testing may not be representative of the total population.

#### Percent of similarity discussion

### Sample bias

The use of statistical techniques requires that sample observations be selected in random manner. This means that each member of a population has the same chance of being selected as any other member. The marketplace seldom produces an entirely random selection of properties that sold. For example, in a given market area a new subdivision may represent 80 percent of all sales but the new subdivision may only contain 5 percent of all the properties in the market area.

However, if the sample is not representative of the population, the measurement taken on the sample would be distorted or skewed, compared to a representative sample. The distortion would be due to a bias in the sample.

Bias is a systematic distortion. It may be due to some flaw in measurement, to the method of selecting the sample, or to the technique of estimating the parameter. Bias due to method of sampling may arise when certain units are given a greater or lesser representation in the sample than in the population. Likewise, if we exclude observations from a sample that should be included in the population we are measuring, our results will be biased.
Bias is seldom desirable, but the important thing is to recognize possible sources of bias and to weigh the effect. Some of the practices we normally use may be a source of bias. These practices are used because the bias is often trivial, and because they may be more precise than unbiased procedures.

To check on bias, DOR personnel are developing the concept of “Percent of Similarity.”

The Percent of Similarity makes a ratio between an average measurement from the population with the same average measurement from the sample. The ratio is simply the small number divided by the large number. The tolerance levels associated with this measurement are in the process of being developed. For the time being, we recommend developing ratios on three different features (RMV, square feet of primary structure, effective age of structure, percent good, or improvement to land ratio). If the average percentage of similarity is greater than or equal to 80 percent, the sample is considered similar to the population.

\[ PS = \frac{\text{small number}}{\text{large number}} \times 100 \]

The average RMV of the population is $207,900. Is the sample biased?

<table>
<thead>
<tr>
<th>MA</th>
<th>Nbhd</th>
<th>P CL</th>
<th>Rej</th>
<th>MAP</th>
<th>Acct</th>
<th>L. RMV</th>
<th>I. RMV</th>
<th>Tot. RMV</th>
<th>Price</th>
<th>Ratio</th>
<th>Month</th>
<th>Year</th>
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</thead>
<tbody>
<tr>
<td>4</td>
<td>1</td>
<td>401</td>
<td>33WD</td>
<td>110515A</td>
<td>00801</td>
<td>$70,300</td>
<td>$152,320</td>
<td>$222,620</td>
<td>$257,000</td>
<td>87</td>
<td>10</td>
<td>93</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>33WD</td>
<td>110306B</td>
<td>00100</td>
<td>$26,530</td>
<td>$96,710</td>
<td>$123,240</td>
<td>$137,500</td>
<td>90</td>
<td>3</td>
<td>94</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>401</td>
<td>120511A</td>
<td>00500</td>
<td>$36,150</td>
<td>$39,310</td>
<td>$75,460</td>
<td>$74,990</td>
<td>101</td>
<td>12</td>
<td>93</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>401</td>
<td>110515B</td>
<td>90010</td>
<td>$63,070</td>
<td>$124,670</td>
<td>$187,740</td>
<td>$182,500</td>
<td>103</td>
<td>8</td>
<td>93</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>401</td>
<td>100436D</td>
<td>02800</td>
<td>$22,450</td>
<td>$131,650</td>
<td>$154,100</td>
<td>$144,900</td>
<td>106</td>
<td>12</td>
<td>93</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>401</td>
<td>140530O</td>
<td>00900</td>
<td>$44,210</td>
<td>$149,800</td>
<td>$167,300</td>
<td>$145,000</td>
<td>115</td>
<td>12</td>
<td>93</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Ave.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$145,540</td>
<td></td>
</tr>
</tbody>
</table>

Answer: The average “Total RMV” from the sample is $145,540, while the average RMV of the population is $207,900. Dividing the small number by the larger gives us Percent of Similarity of just 70 percent. The sample appears biased.

Test to determine validity:
- RMV frequency distribution of the sales array should be similar to the RMV frequency distribution of the population.
- Land–to–building ratios of the sales array should be similar to the land to building ratios of the population.

When the sample is not representative of the market area, this measurement assists in documenting that the sample is not reliable to make an area wide adjustment. Therefore, this demonstrates the need to expand the analysis. This expansion is usually in the form of increasing your database, or recommending that the area being measured will require revaluation.

This is just one set of testing options in this process of determining the validity of the samples.

**Measure of reliability**

After establishing validity, another important aspect of the ratio study is its reliability. Decisions made using ratio studies have the potential of affecting hundreds of thousands of RMVs across the state. Reliability, in a statistical sense, concerns the degree of confidence one can place in a calculated statistic for an array. Measures of reliability will indicate whether one can have a desired degree of confidence that a given level of appraisal has been achieved.

This does not mean that measures of central tendency that fail to meet official requirements should be tolerated. When measures of reliability are wide due to small arrays, poor uniformity, or both, additional data are required for proper analysis or alternative action. If poor uniformity is the cause, a reappraisal may be needed.

Given a representative array, reliability depends on two factors.

1. Size of the array.
2. Uniformity within the array.

A 95 percent confidence interval means that you could be 95 percent confident that the array is a true representation of the market area. The development of 95 percent confidence intervals is based on the:

1. Mean,
2. Median, or
3. Weighted mean.

The following table can be used to determine whether an array size is adequate based on a 95 percent confidence interval.
**Statistical analysis**

### 95 percent confidence interval

<table>
<thead>
<tr>
<th>Array size of at least</th>
<th>COV = 10</th>
<th>COV = 20</th>
<th>COV = 30</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>± 12.4%</td>
<td>± 24.8%</td>
<td>± 37.2%</td>
</tr>
<tr>
<td>10</td>
<td>± 7.2%</td>
<td>± 14.3%</td>
<td>± 21.5%</td>
</tr>
<tr>
<td>50</td>
<td>± 2.8%</td>
<td>± 5.5%</td>
<td>± 8.3%</td>
</tr>
<tr>
<td>100</td>
<td>± 2.0%</td>
<td>± 3.9%</td>
<td>± 5.9%</td>
</tr>
<tr>
<td>300</td>
<td>± 1.1%</td>
<td>± 2.3%</td>
<td>± 3.4%</td>
</tr>
</tbody>
</table>

**Example:**

Selected Ratio = 90 (Selected ratio from any of the three central tendencies)

COV = 20

Array size = 50

Given the three component criteria above, you can be 95 percent confident that the actual ratio is between 94.95 and 85.05 percentile, computed as follows using the 95 percent confidence interval table above:

\[
\begin{align*}
1. & \quad 0.055 \times 90 = 4.95 \\
2. & \quad 90 + 4.95 = 94.95 \\
3. & \quad 90 - 4.95 = 85.05 \\
\end{align*}
\]

The ratio of 90, plus or minus the confidence of 4.95, reflects a range of ratios between 85.05 and 94.95 at a 95 percent confidence level. You can be 95 percent confident that if you ran an array from this same study area at a later time, the ratio would fall between 87.93 and 92.07.

In the second example, by adjusting only the array size, there is a greater confidence in the interval results reflecting increased reliability of the array. This is demonstrated by the reduced range between the ratios in the second example at 4.14 versus the first example at 9.9.

If, after analyzing the array, you find the reliability measures unacceptable because of a wide range of ratios, then adjustment of this population’s values based on this array may indicate valuation problems. Further studies or alternate valuation process (e.g., reappraisal or recalculation) may be best for valuing this market area. This is an optional process to the preparation of the ratio study and not required to be part of the published product—but a helpful step in analyzing your available data. The example and steps on the previous page lead to a 95 percent confidence interval.

This next example demonstrates that the selected ratio of 93 is not a supportable market indication because of the 46.13 confidence level range. From this, additional analysis is needed for this market area.

### AAD from

<table>
<thead>
<tr>
<th>RMV</th>
<th>Sale</th>
<th>Ratio</th>
<th>Central tendencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>$64,990</td>
<td>$97,000</td>
<td>67</td>
<td>W. Mean 98</td>
</tr>
<tr>
<td>$83,950</td>
<td>$115,000</td>
<td>73</td>
<td>Median 94</td>
</tr>
<tr>
<td>$98,400</td>
<td>$120,000</td>
<td>82</td>
<td>Mean 93</td>
</tr>
<tr>
<td>$89,250</td>
<td>$85,000</td>
<td>105</td>
<td></td>
</tr>
<tr>
<td>$260,000</td>
<td>$230,000</td>
<td>113</td>
<td></td>
</tr>
<tr>
<td>$198,000</td>
<td>$165,000</td>
<td>120</td>
<td></td>
</tr>
<tr>
<td>$794,590</td>
<td>$812,000</td>
<td></td>
<td></td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>6 Sales</th>
<th>Selected Ratio</th>
<th>95%</th>
<th>Conf</th>
<th>95%</th>
<th>Conf</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAD</td>
<td>19</td>
<td>93</td>
<td>x</td>
<td>0.248</td>
<td>=</td>
</tr>
<tr>
<td>COD</td>
<td>21</td>
<td>93</td>
<td>+</td>
<td>23.06</td>
<td>=</td>
</tr>
<tr>
<td>St Dev</td>
<td>22</td>
<td>93</td>
<td>–</td>
<td>23.06</td>
<td>=</td>
</tr>
<tr>
<td>COV</td>
<td>24</td>
<td></td>
<td></td>
<td>46.13</td>
<td>=</td>
</tr>
<tr>
<td>PRD</td>
<td>0.95</td>
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<td></td>
</tr>
</tbody>
</table>
Weighting

The weighting calculation process is used to keep base land RMVs of both improved accounts and vacant land accounts consistent with each other.

Weighting is a process that maintains uniformity between the land component of improved properties and unimproved properties. To achieve the overall adjustment after applying the vacant land adjustment to the land component of improved properties, the weighting process will designate the adjustment that must be applied to the improvement component.

Components of the overall RMV that must be available are:

- Land;
- On-site developments (OSD);
- Improvements; and
- Outbuildings.

Equity or uniformity should be maintained between improved land values and comparable vacant land within a market area.

If the values of vacant land and improved land appear to be moving at different levels, caution must be employed to ascertain that the correct land value basis is being used. Any other incremental influences of value are likely to indicate OSD or improvement elements that reflect the current market. Keep in mind that the land RMV is the first component established in the pre-appraisal set-up. This forms the basis by which all the other elements of the set-up are developed—such as the land and depreciation schedules, improvement class benchmarks, etc.

The current laws allow taxpayers to appeal land or improvements separately. These two components are further broken down into land including on-site developments, and improvements including outbuildings. Our valuation system recognizes all of these components and attributes values to each based on appropriate studies.

By weighting, the proportions of the overall adjustment can be identified and applied to each component of value, resulting in a total value for the property that accurately reflects the separate component values.

Land-to-building ratios play an important role in the weighting process. Incorrect land-to-building ratios in an area will result in value inequities from appeal orders dealing with only one component of value.

The weighting calculation process should be used when data are analyzed and each component is to be adjusted.

When only one component ratio is known, the purpose of the computation is to solve for the “unknown” ratio. When both ratios have been calculated, an adjustment factor can be computed that will be applied to the appropriate component.

The following methods are used to calculate an “unknown” ratio, subject to availability of data:

1. **The Market Area (Population)**—uses RMV totals of each component:
   - Actual RMV of components in the market area.
   - Percentage of the component’s RMV in the market area.

2. **The Sales Sample**—is reliable when the sales sample is representative of the total population:
   - Uses actual RMV from the sample.
   - Percentage of each component’s RMV to the total RMV in the sample.

Elements needed to compute an “unknown” ratio for a market area or property classes are:

- RMV or percentage of the components;
- The overall ratio (change adjusted when appropriate);
- At least one component ratio (change adjusted when appropriate);
- Known component ratios from other studies, such as OSD, outbuildings, etc., may be used.

The ultimate goal in the weighting process is to distribute the overall adjustment in proper proportions among the components of value (land, improvements, outbuildings, and on-site development). It is recommended to use the total RMV (of each market area) and the total RMV of each component to conclude a weighted ratio. This method is preferred to best represent the total population of the market area. As in contrast, in any given year, the sales sample may not accurately represent these components of value in the market area.

The following three examples illustrate proper weighting procedures. The first two use land and improvements only. The third uses all the components of value: land, on-site development, improvements, and outbuildings.

**Note:** RMVs are used for all examples.

**Example #1:** Using the RMV of components.

**Example #2:** Using the percentage of land and improvements.

**Example #3:** Using the percentage of components to compute the ratio for the improvements when the ratios for land, on-site developments, and outbuildings are known.
**Example #1**

**Task:** Calculate the current year ratio for improvements using known ratios and RMV of land and improvements.

**Known:** Market area 1, property class 1-0-1

A ratio for land is 90 (determined from vacant land sales).

An overall ratio of 95 (determined from the improved accounts).

**RMV of all improved accounts:**

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total RMV Land</td>
<td>$33,077,860</td>
</tr>
<tr>
<td>Total RMV Improvement</td>
<td>$174,785,320</td>
</tr>
<tr>
<td>Total RMV</td>
<td>$207,863,180</td>
</tr>
</tbody>
</table>

**Steps:**

1. Calculate “projected” year RMV total for the land portion of the improved accounts.

   Divide the current year total land RMV by the ratio of 90 from vacant land sales.

   \[
   \frac{33,077,860}{.90} = 36,753,178
   \]

2. Calculate “projected” year RMV total for the improved accounts.

   Divide current year total RMV by the overall ratio of 95 from the improved sales.

   \[
   \frac{207,863,180}{.95} = 218,803,347
   \]

3. Calculate the “projected” year RMV for improvements.

   Subtract the calculated “projected” year RMV of the land from the calculated total “projected” year RMV of improved accounts.

   \[
   218,803,347 - 36,753,178 = 182,050,169
   \]

4. Calculate the improvement ratio.

   Divide the total current RMV of improvements by the “projected” year calculated RMV for improvements.

   \[
   \frac{174,785,320}{182,050,169} = 0.96094247 = 96 
   \]

**Example #2**

**Task:** Calculate the ratio for improvements using current RMV of land and improvements as **percentages** of total current RMV.

**Known:** market area 1, property class 1-0-1

A ratio for vacant land of 90 was determined from vacant land sales.

Overall ratio of 95 was determined for improved accounts.

**RMV of all improved accounts:**

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total RMV Land</td>
<td>$33,077,860</td>
</tr>
<tr>
<td>Total RMV Improvement</td>
<td>$174,785,320</td>
</tr>
<tr>
<td>Total RMV</td>
<td>$207,863,180</td>
</tr>
</tbody>
</table>

**Steps:**

1. Calculate the percentages for current year RMV land and improvements.

   Divide current year total land RMV by total RMV.

   \[
   \frac{33,077,860}{207,863,180} = .159132849 = 15.91\% 
   \]

2. Calculate the current year improvement RMV by total RMV.

   \[
   \frac{174,785,320}{207,863,180} = .840867151 = 84.09\% 
   \]

3. Calculate the current year improvement ratio.

   \[
   \begin{align*}
   &1. \text{Land Wt} + \text{Imp Wt} = \text{Total Wt} \\
   &\frac{.1591}{.90} + \frac{.8409}{X} = \frac{1.00}{.95} \\
   &2. \frac{.1768}{90} + \frac{.8409}{X} = 1.0526 \\
   &3. \frac{.8409}{X} = .8758 \\
   &4. \frac{.8409}{X} = .8409 \times X \\
   &5. .8409 = .8758 \times X \\
   &6. \frac{.8409}{.8758} = X \\
   &7. .9602 = X \text{ or } X = 96 \text{ (rounded)}
   \end{align*}
   \]
**Example #3**

**Task:** To calculate the ratio for improvements, using the percentage-weight of the component(s) and the ratios from the vacant land and special studies for on-site developments, out buildings, and vacant land.

**Known:** Market area 1, property class 4-0-1

<table>
<thead>
<tr>
<th>Components</th>
<th>Real market values</th>
<th>Ratios</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land RMV</td>
<td>$40,000,000</td>
<td>90</td>
</tr>
<tr>
<td>On-site development RMV</td>
<td>$5,000,000</td>
<td>100</td>
</tr>
<tr>
<td>Outbuildings RMV</td>
<td>$10,000,000</td>
<td>98</td>
</tr>
<tr>
<td>Improvement RMV</td>
<td>$145,000,000</td>
<td>X</td>
</tr>
<tr>
<td>Total RMV</td>
<td>$200,000,000</td>
<td>95</td>
</tr>
</tbody>
</table>

**Steps:**

1. Compute the percent weight for each component value.

<table>
<thead>
<tr>
<th>RMV</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land</td>
<td>$40,000,000</td>
</tr>
<tr>
<td>On-site developments</td>
<td>$5,000,000</td>
</tr>
<tr>
<td>Outbuildings</td>
<td>$10,000,000</td>
</tr>
<tr>
<td>Improvements</td>
<td>$145,000,000</td>
</tr>
<tr>
<td>Totals</td>
<td>$200,000,000</td>
</tr>
</tbody>
</table>

2. Compute improvement ratio:

\[
\frac{\text{Known ratio}}{\text{Unknown ratio}} = \frac{1}{1} \\
\frac{.20}{.90} + \frac{.025}{1.00} + \frac{.05}{.98} + \frac{.725}{X} = .95
\]

3. \[X = 1.0526 - .2222 - .0250 - .0510 = .7544\]

4. \[X = .7544\]

5. \[X = .9610 \text{ or } .96 \text{ (rounded)}\]
Manfactured structures are built off-site and are designed to be moved on the public highways. They have sleeping, cooking, and plumbing facilities; are intended for human occupancy; and are used for residential purposes. This includes manufactured dwellings, mobile homes, manufactured homes, and recreational structures. They are further identified by year of manufacture and limitations of use as described in ORS 446.003.

Modular homes/structures: According to ORS 308.866, “‘mobile modular unit’ means a prefabricated structure that is more than eight and one-half feet wide, is used for commercial or business purposes and is capable of being moved on the highway.”

Sources of sales data on manufactured structures may include title transfers, dealer sales records, multiple listing service, confirmation letters, and field discovery.

The manufactured structure class (x-x-9) in the original sales run should include all valid manufactured structure sales countywide and by valuation area. The ratios may not be an accurate reflection of the value of different types of manufactured structures—the reader will wonder why.

Manufactured structure sales

Items to consider when analyzing manufactured structure sales include:

- Condition of the property at the time of the sale is important when considering the sale price. Field inspection may be necessary.
- Examine the listed characteristics of the manufactured structure to ensure the inventory is accurate.
- Compare single-wide and multi-section manufactured structures separately. Usually, a definite breaking point in the sales prices between the two is apparent.
- Housing and Urban Development (HUD) established new building codes in 1976 for new manufactured housing units, which also created a market separation. Analysis by types (single-wide vs. multi-section) and/or age (pre-'76 vs post-'76) may identify significantly different ratios and RMV adjustments.
- Marketing changes in the manufacturing process allowed for many optional upgrades and interior modifications, underscoring the need for interior inspections. Determine a “base” price prior to upgrade options whenever possible.
- Identify which elements are included in the sale (e.g., “park-packages,” carports, garages, decks, landscaping, etc.). Properly identify which improvements are attributed to the park or to the manufactured structure.
- Existing manufactured structure values may reflect less depreciation than in the past because of improved quality standards and increased demand for affordable housing.
- Significant value deviations sometimes exist when manufactured structures are located in different parks and planned communities. Reviewing these sales is critical to determine whether the value difference is attributable to the structure or the location.

The following example is a countywide manufactured structure study that is then stratified (or sorted) by single and multiple section structures.
## Manufactured structures (countywide)

### Current certified roll

<table>
<thead>
<tr>
<th>Appraisal/valuation area</th>
<th>Account number</th>
<th>Date of sale</th>
<th>Size</th>
<th>Year built</th>
<th>Real market value</th>
<th>Sale price</th>
<th>Sale no.</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>911160</td>
<td>May</td>
<td>24 x 50</td>
<td>1989</td>
<td>$17,900</td>
<td>$24,000</td>
<td>1</td>
<td>75</td>
</tr>
<tr>
<td>1</td>
<td>1149180</td>
<td>Feb</td>
<td>24 x 66</td>
<td>1989</td>
<td>36,400</td>
<td>46,500</td>
<td>2</td>
<td>78</td>
</tr>
<tr>
<td>4</td>
<td>949086</td>
<td>Dec</td>
<td>10 x 55</td>
<td>1971</td>
<td>4,500</td>
<td>5,500</td>
<td>3</td>
<td>82</td>
</tr>
<tr>
<td>4</td>
<td>944590</td>
<td>Apr</td>
<td>10 x 57</td>
<td>1975</td>
<td>10,200</td>
<td>12,500</td>
<td>4</td>
<td>82</td>
</tr>
<tr>
<td>2</td>
<td>993504</td>
<td>Mar</td>
<td>24 x 48</td>
<td>1988</td>
<td>22,400</td>
<td>26,900</td>
<td>5</td>
<td>83</td>
</tr>
<tr>
<td>2</td>
<td>940744</td>
<td>Jun</td>
<td>10 x 50</td>
<td>1971</td>
<td>5,400</td>
<td>6,000</td>
<td>6</td>
<td>90</td>
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<tr>
<td>5</td>
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<td>Feb</td>
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<td>1982</td>
<td>25,200</td>
<td>28,000</td>
<td>7</td>
<td>90</td>
</tr>
<tr>
<td>3</td>
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<td>Mar</td>
<td>12 x 60</td>
<td>1979</td>
<td>7,600</td>
<td>8,000</td>
<td>8</td>
<td>95</td>
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<tr>
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<td>1981</td>
<td>16,800</td>
<td>17,500</td>
<td>9</td>
<td>96</td>
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<td>1980</td>
<td>19,600</td>
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<td>98</td>
</tr>
<tr>
<td>5</td>
<td>923530</td>
<td>Jan</td>
<td>14 x 64</td>
<td>1987</td>
<td>15,900</td>
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<td>99</td>
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<td>12 x 64</td>
<td>1981</td>
<td>10,900</td>
<td>10,995</td>
<td>13</td>
<td>99</td>
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<tr>
<td>2</td>
<td>933887</td>
<td>Jan</td>
<td>10 x 48</td>
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<td>103</td>
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<td>1981</td>
<td>11,800</td>
<td>11,000</td>
<td>18</td>
<td>107</td>
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<tr>
<td>5</td>
<td>924049</td>
<td>Jan</td>
<td>14 x 70</td>
<td>1987</td>
<td>16,400</td>
<td>15,000</td>
<td>19</td>
<td>109</td>
</tr>
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<td>24 x 56</td>
<td>1982</td>
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<td>20</td>
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</tr>
<tr>
<td>1</td>
<td>923503</td>
<td>Mar</td>
<td>24 x 64</td>
<td>1988</td>
<td>39,900</td>
<td>36,000</td>
<td>21</td>
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<td>Feb</td>
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<td>1984</td>
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<td>34,500</td>
<td>24</td>
<td>114</td>
</tr>
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<td>924334</td>
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<td>12 x 48</td>
<td>1988</td>
<td>21,700</td>
<td>18,400</td>
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<td>118</td>
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<td>14 x 64</td>
<td>1982</td>
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<td>1983</td>
<td>14,700</td>
<td>9,000</td>
<td>29</td>
<td>163</td>
</tr>
</tbody>
</table>

**Totals:**

| Sum | 561,400 | 555,790 | 3,009 |

**Mean:** 104

**Weighted mean:** 101

**Median:** 103
## Single-Wide Manufactured Structures

<table>
<thead>
<tr>
<th>Appraisal/valuation area</th>
<th>Account number</th>
<th>Date of sale</th>
<th>Size</th>
<th>Year built</th>
<th>Real market value</th>
<th>Sale price</th>
<th>Sale no.</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>949086</td>
<td>Dec</td>
<td>10 x 55</td>
<td>1971</td>
<td>$4,500</td>
<td>$5,500</td>
<td>1</td>
<td>82</td>
</tr>
<tr>
<td>4</td>
<td>944590</td>
<td>Apr</td>
<td>10 x 57</td>
<td>1975</td>
<td>10,200</td>
<td>12,500</td>
<td>2</td>
<td>82</td>
</tr>
<tr>
<td>2</td>
<td>940744</td>
<td>Jun</td>
<td>10 x 50</td>
<td>1971</td>
<td>5,400</td>
<td>6,000</td>
<td>3</td>
<td>90</td>
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<tr>
<td>3</td>
<td>927411</td>
<td>Mar</td>
<td>12 x 60</td>
<td>1979</td>
<td>7,600</td>
<td>8,000</td>
<td>4</td>
<td>95</td>
</tr>
<tr>
<td>1</td>
<td>928116</td>
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<td>1981</td>
<td>16,800</td>
<td>17,500</td>
<td>5</td>
<td>96</td>
</tr>
<tr>
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<td>923530</td>
<td>Jan</td>
<td>14 x 64</td>
<td>1987</td>
<td>15,900</td>
<td>16,000</td>
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<td>1981</td>
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<td>10 x 48</td>
<td>1973</td>
<td>5,500</td>
<td>5,500</td>
<td>8</td>
<td>100</td>
</tr>
<tr>
<td>3</td>
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<td>14 x 60</td>
<td>1981</td>
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<td>Sep</td>
<td>14 x 47</td>
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<td>14,700</td>
<td>9,000</td>
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<td>163</td>
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</tbody>
</table>

**Totals:**
- $206,900
- $190,345
- 1,841

**Mean:** 108  
**Weighted mean:** 109  
**Median:** 107

## Multi-Section Manufactured Structure Table

<table>
<thead>
<tr>
<th>Appraisal/valuation area</th>
<th>Account number</th>
<th>Date of sale</th>
<th>Size</th>
<th>Year built</th>
<th>Real market value</th>
<th>Sale price</th>
<th>Sale no.</th>
<th>Ratio</th>
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</thead>
<tbody>
<tr>
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<td>1981</td>
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<td>1982</td>
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<td>24 x 52</td>
<td>1984</td>
<td>39,400</td>
<td>34,500</td>
<td>12</td>
<td>114</td>
</tr>
</tbody>
</table>

**Totals:**
- $354,500
- $365,445
- 1,169

**Mean:** 97  
**Weighted mean:** 97  
**Median:** 101
When the initial sales listings are inadequate, supplemental studies are necessary to develop reliable ratio conclusions.

**Examples**

Supplemental studies are prepared and analyzed in the same consistent manner as other studies. The following supplemental studies are recognized and approved by the Department of Revenue:

A. Combined property class study  
B. Market area study  
C. Sub-area study  
D. Appraisal ratio study  
E. Rent study  
F. Outbuilding study  
G. Multiple listing study (properties for sale)  
H. Building class study  
I. Value range study  
J. Age/life study  
K. Multi-year study  
L. Straddle study or time period study

**Appraisal ratio studies**

Appraisal ratio studies are a physical appraisal of a sample of properties typical of the market area. Appraisal ratio studies are used when sales data are not adequate to derive valid ratio conclusions. An appraisal ratio study is compiled and computed in the same manner as a sales ratio study. Current certified roll values are divided by the newly reappraised values to derive ratio conclusions for the remaining properties in the area.

A qualified appraiser, other than the one who originally appraised the properties, should appraise a random sample of properties. The sample should include enough accounts to be representative of the property class and market area.

Data that can be used in an appraisal ratio study includes: gross rent multipliers, construction cost indices, prior years’ sales, real estate trends, and sales data from other counties.

The procedure for an appraisal ratio study includes the following steps:

1. Select a random sampling (usually 1 percent of accounts) of properties to be appraised.  
2. Assign a qualified appraiser to appraise the properties.  
3. Examine the selected properties.  
4. Correlate data (sales, gross rent multipliers, cost indices, etc.). Place value estimates on properties.  
5. Compute ratios by comparing newly appraised values of sample with current roll RMVs.  
6. Conclude ratio array, analyze ratios for anomalies within the market area and property class.

**Straddle study**

A straddle or time period study is any study where the sample is developed from sales spanning equal distance from each side of a specific point (e.g., assessment date).

**Examples**

January 1 is the assessment date. A six-month study of sales should include October, November, December, January, February, and March.

This study can be used as an after-ratio study to ascertain that corrective trends applied did, in fact, bring roll values to 100 percent RMV.

These studies are also used when properties are revalued annually to test the new values for 100 percent RMV as of the set-up date.
Section 10—Preparing and assembling

The ratio study

The ratio study determines the necessary factors to be applied to properties that have not sold based on those that have sold to achieve a ratio level of 100 percent of RMV. The assessor makes ratio conclusions for each class of locally valued property and within each appraisal valuation area.

Data may be taken from the ratio study reports and compiled into various statistical studies. Various parties may use individual pages, such as hearing officers, the attorney general’s office, and Legislative Revenue. Therefore, the ratio study report must include the data as required by the Department of Revenue. See Section 4.

The study includes:

- The basis for the ratio conclusions.
- Reasoning for the selected ratio if indications (mean, median, and weighted mean) are more than five points apart from the highest to lowest.
- Notation and page number of any supplemental study used to develop the ratio conclusion. Such studies may include a two-year sample, combined market areas, and combined property classes.
- The adjustments the assessor plans to make to each property class to bring its value to 100 percent of RMV.
- Computation worksheets of ratios and ratio conclusions by property class for each market area countywide.
  1. Ratios before appraisal, recalculation, and adjustment.
  2. Ratios after appraisal, recalculation, and adjustment.
- Actual sales, appraisals, and other data used to arrive at the ratio conclusions.
- Computations and conclusions for any supplemental studies that may be included. Some supplemental studies are bulky. In that case, a copy must be available in the assessor’s office so Department of Revenue personnel and others can examine it upon request.
- Summary pages showing the before and after ratios and the adjustments that will be made to land, buildings, and other components.
- For those counties utilizing recalculation, a supplemental straddle study of sale data that are evenly distributed on either side of the assessment date.

The summarized components of the ratio study are:

1. Table of contents;
2. Certification page;
3. Introduction;
4. County map;
5. Property classification codes, if expanded from state-issued codes;
6. Sale condition codes, if expanded from state-issued codes;
7. Time trend analysis to the assessment date.
8. Summary of adjustments and “after” ratio adjustments;
9. Market area conclusions and adjustment(s) pages;
10. Pages identifying the specific areas and property classes being adjusted, including:
   - “Before” and “after” ratios;
   - Explanations for the selected ratios;
   - Valuation histories of CODs and PRDs;
   - Time adjustments, if applicable;
   - Listings of sales and summaries with condition codes and statistics (mean, median, weighted mean, COD, COV, and PRD);
   - An “After Ratio Study” for areas revalued, re-appraised, or recalculated. The after ratio study is a sales to RMV ratio study that is designed to test whether or not a county’s annual valuation program has produced RMVs that meet the statutory requirement to bring all properties to 100 percent of RMV. See OAR 309.200-(B)(12).

The ratio study must include the following:

- Table of contents;
- Certification and analysis of valuation methods and procedures;
- Introduction;
- County map;
- Property class code listing and descriptions.
- Time trend analysis;
- Summary of adjustments and after ratios (multiple pages).

(For all property classes/units and market areas, with or without planned adjustments)

- Residential;
- Tract;
- Multi-family;
- Market farm and forest;
- Commercial;
- Industrial;
- Manufactured structures;
- Recreation;
- Other (waterfront, etc.).

- Market area conclusions and adjustments (multiple pages).
Preparing the ratio study

Include the following on each page:

— **Identification of market area:** Property class code(s), market area(s), boundary definition, property type(s), or unit type(s).

— **Adjustment calculation summary:**
   - **Sample size**
     - Population—number of accounts.
     - Sample—number of sales.

— **Weighting calculations (for improved property types only):**
   Prior year RMV of sample or population of components (land, on-sites, improvements, etc.).

   Weight of the components as a percent of total sample or roll.

— **Ratio selections & adjustment factors:**
   - Selected ratio from array.
   - Time trend factor.
   - RMV before ratio.

   Adjustment factors: Overall, land, on-sites, improvements, and other.

   After ratio.

— **Selected ratio explanation.**

— **Valuation history (Six-year history—dates shown are examples):**
   - Year last appraised.

   Last four and current year COD before adjustment, if available.

   Last four and current year PRD before adjustment, if available.

- **Pertinent sales listings, supplemental studies, and computations of statistical data supporting each market area conclusion and adjustment page:**
  - Residential.
  - Commercial.
  - Industrial.
  - Tract.
  - Market farm and forest.
  - Multi-family.
  - Recreation.
  - Manufactured structures.
  - Other (waterfront, etc.).

- **Additional studies and conclusions:**
  - Regression studies.
  - Other.

- **Appraisal/valuation plan for the next assessment year; i.e., the following July 1** (may be prepared as a separate document on or before November 1).

**Assessor’s ratio study**

- Basic guideline format and order must be followed.
- Sales listing and statistics must be included.
- Individual pages may be formatted to suit county needs.

Questions should be directed to the field office assigned to the county for which the report is to be or has been compiled.
Assessor’s certified ratio study

For year ____________

County name

______________
### Table of contents

20 ___ ratio study, ________________ County

<table>
<thead>
<tr>
<th>Certification and analysis of valuation methods and procedures</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td></td>
</tr>
<tr>
<td>County map</td>
<td></td>
</tr>
<tr>
<td>Listing of property class codes and descriptions</td>
<td></td>
</tr>
<tr>
<td>Time trend analysis</td>
<td></td>
</tr>
<tr>
<td>Summary of adjustments and after ratios (multiple pages)</td>
<td></td>
</tr>
<tr>
<td>(Include all property classes and market areas, even those with no planned adjustments.)</td>
<td></td>
</tr>
<tr>
<td>Residential</td>
<td></td>
</tr>
<tr>
<td>Rural tract</td>
<td></td>
</tr>
<tr>
<td>Multifamily</td>
<td></td>
</tr>
<tr>
<td>Market farm and forest</td>
<td></td>
</tr>
<tr>
<td>Commercial</td>
<td></td>
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<td>Industrial</td>
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<tr>
<td>Manufactured structures</td>
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<tr>
<td>Recreation</td>
<td></td>
</tr>
<tr>
<td>Others as necessary</td>
<td></td>
</tr>
<tr>
<td>Market area/unit conclusions and adjustments (multiple pages)</td>
<td></td>
</tr>
<tr>
<td>(Complete all required items on each page. Behind each, insert pertinent sales listings, graphs, supplemental studies, and computations of statistical data.)</td>
<td></td>
</tr>
<tr>
<td>Residential</td>
<td></td>
</tr>
<tr>
<td>Rural tract</td>
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<td>Industrial</td>
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<td>Manufactured structures</td>
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<td>Recreation</td>
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<td>Others as necessary</td>
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<tr>
<td>Supplemental studies and conclusions</td>
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<tr>
<td>Appraisal valuation plan</td>
<td></td>
</tr>
</tbody>
</table>
Certification

20 ___ ratio study, ____________________ County

Certification & analysis
of
valuation methods and procedures

State of Oregon

) ) SS.

County of

)

I, ______________ , assessor of county ______________ , State of Oregon, do hereby certify that I have prepared a ratio study for the current tax year, according to ORS 309.200 and guidelines developed by the Department of Revenue. The attached is a complete and accurate copy of the original now on file in my office.

I further certify that the ratios and adjustments identified in this study will achieve 100 percent of RMV for real property and manufactured structures for the current year.

This report is given to the Department of Revenue and will be given to the Clerk of the Board of Property Tax Appeals to provide current knowledge of the adjustment program used by my office.

____________________________________  _______________________
Assessor’s signature  Date

____________________________________  _______________________
Contact person  Date
Preparing the ratio study

Introduction

20 assessor’s certified ratio study, ________ County

The purpose of this ratio study is to:

- Measure the real market value level from year to year.

For this study, that is the relationship between current certified roll real market values and the real market values required for the pending roll. This measurement is the before ratio on each “market area conclusions and adjustments” page.

- Identify adjustment factors necessary to achieve the required RMVs for the current roll.
- Document the analysis and decision-making process.
- Provide a tool in managing the county appraisal and adjustment programs.

Note: It’s important to remember that all references in this introduction to value levels only pertain to real market values.

Ratio study format

The ratio study format is designed to be flexible and illustrate the adjustment program. The most important pages are the “summary of adjustments and after ratios,” beginning on page ___, the “market area conclusion and adjustment” pages with the supporting sales listings and statistics behind them, and the change in market conditions (time) trend analysis.

Scope of this report

Not all property values are actually indexed or trended each year. Personal property, specially assessed property, and some industrial properties are recalculated each year. This ratio study format does not report on values being recalculated but does report on how real market values will be adjusted.

Status of the assessor’s adjustment program

The ________ assessor’s office will continue to review market information. It is possible that additional data or further analysis will lead to different conclusions than contained in this study. Changes to this study will be reported to the department and to the board of property tax appeals.

Change ("time") trend analysis

The primary purpose of the study is to identify adjustment factors to be applied to sales prices or to the selected ratios. The intent is to estimate the prices at which the property would have sold on the assessment date (January 1 at 1:00 a.m.). This section includes trend conclusions and the reasons for the trends. The data is usually presented in graphic form by month and or quarter, with some narrative explanations. Change trends may be developed for any property grouping desired, but an adequate sales sample is necessary.

Description of “summary of adjustments and after ratio” page(s)

These pages identify market areas and specify the related study, the page number of the “market area conclusions and Adjustments” page(s), and the adjustment factor(s) required by the study. The market areas are organized to emphasize the relationship between areas.

- Counties that recalculate RMV by property class by market area do not provide adjustment factors.
- Recalculating counties will send this information as “an after ratio” study.

Market areas are divided into four major groups:

1. Residential—This section is for residential land, single family dwellings, condominiums, duplexes, triplexes, four-plexes and manufactured structures (mobile homes).
2. Rural—This section is for rural property parcels, whether small rural residential or large farm and forest. Besides residential improvements there are adjustment areas specifically for farm and forest buildings.
3. Income—This section is for income property. It includes both land and improvements for commercial, industrial, and multifamily properties.
4. Other—This section is for land and improvements that do not fit neatly into any of the other categories. Mineral rights [if it is actively being mined as of the assessment date-ORS 308.115 (2)] and site improvements may be found here.

Appraisal areas—The county is divided into __________ appraisal areas.

Insert county-specific information with descriptions of the geographic area boundaries and characteristics.

[Insert countywide map here]

Appraisal areas and/or market areas are needed to manage valuation programs and provide an organized system by which to analyze sales data, apply trends, or revalue as necessary to maintain 100 percent RMV.

Market areas—The assessment system provides for adjusting values by market areas within and across appraisal area boundaries. The following maps display how parts of the county have been stratified into market areas (optional).

[Insert maps here]
**Preparing the ratio study**

**Stratification**—The technical word for taking a large group of properties and splitting it into separate market areas based on some criteria. This step is taken when there is reason for applying different adjustments to the different market areas. This usually means that the market areas have different ratio indications and the deviation from central tendency will be reduced by the stratification. Conversely, combinations of sales data for similar classes which separately have few or no sales can be justified on the basis of general economic conditions.

**“Market area conclusions and adjustment” pages**

The name or number is to identify the individual ratio study that produced the adjustment factors to be applied to a market area or unit type. The same study may be used for multiple market areas.

**Page #**—The number in the lower right corner on the individual ratio study pages named “market area conclusions and adjustments.”

**Adjustment (adj.)**—This is the factor to be multiplied by the existing value(s). The source of this factor is the individual ratio study. Studies are done to calculate the adjustments needed for each component of a property class to reach an overall result of 100 percent of real market value for the properties. The overall adjustment factor may not accurately reflect the combined adjustments for any specific property because of the various weights of components in individual properties.

**After ratio**—This is the expected level of RMV assessment after the adjustment process. The ___________ County assessor will adjust all real market values to 100 percent of market.

The most effective way to manage a valuation program is to concentrate on results rather than the valuation process. Consequently, a more direct focus on the “after ratio” is required. Establishing standards to measure results has been a priority, and will provide a basis for determining acceptable performance.

**Market area conclusions and adjustments page terms explanations**

Individual study pages identify the market area in more specific terms, such as the geographics of the market area and type of properties and conditions. Each study page shows the selected ratio and calculation of the adjustment factor(s) and explanation for the selected ratio. Following each study page are the sales listing and related statistics.

- **Property class/type**—Identifies the type of property, such as residential, commercial, etc.
- **Market area name, number code or unit type**—A name, number, and code or unit type identified in detail in the market area identification section.
- **Location/description**—A descriptive identification of the market area other than a number or code, such as: geographic location, building/land characteristics, or a description of the properties to be adjusted.
- **Adjustment calculation summary**—This section displays the sample size and weighting quantities involved in calculating adjustment factors for the selected ratio.

**Sample size**—Number of usable sales divided by the number of accounts or units of the property class in the market area, figured as a percentage to approximate the sample size.

**Number of sales**—Number of sales used in the calculation of the “Before Ratio.”

**Population of accounts or units**—This is the total number of accounts or units within the property class by market area for which you are calculating the ratio.

**Weighting calculations (for improved property types only)**—Increases or decreases in the market may differ for separate components of an improved property class. A percent weight for the land, on-sites, improvements, and other (outbuildings) is computed from the prior year total improved property class or from the current sample computed. **Note:** Counties that do not adjust RMV by trending do not complete this portion.

**Ratio selection and adjustment factors**

**Selected ratio**—An estimate of the level of real market value on January 1. Ratio selection has been based on the following principles:

A. No one sale should have a large influence on the ratio indication.
   1. Avoid an arithmetic mean distorted by extreme ratios.
   2. Avoid a weighted mean influenced by high valued properties at either end of the array.
   3. Avoid a median when gaps exist in the middle of the frequency distribution.

B. Split ratios (when an individual study has ratio indications above and below 100) can be the result of being at or near market.
   1. A correct index will result in half the properties being over market and half being under market.
   2. Application of a single index cannot reduce the distribution of ratios within a property class.

C. The central tendencies (median, arithmetic mean, geometric mean, weighted mean, and mode) are
analyzed and an appropriate ratio becomes the selected ratio.

Before ratio—a measure of the level of real market value at an established point in time for the tax year, before any trending adjustments are applied.

Total adjustment (or adjustment factor)—the adjustment to bring the certified roll real market values to the statutorily required 100 percent of real market value as of the study’s assessment date. For single component property class or unit types it is calculated by dividing 100 by the “RMV before ratio.” For improved properties being trended the overall adjustment is broken into the following components:

Land adjustment—The adjustment factor by which land of a given type is to be adjusted. It is usually calculated as 100 divided by the “RMV before ratio” for a class composed of vacant land. The same adjustment is then used for both vacant and improved land in order to maintain equitability.

Site adjustment—The adjustment factor to apply to the site improvement component of the property class that will bring the site improvement component to 100 percent of RMV as part of the overall adjustment.

Improvement adjustment—The adjustment factor to apply to the improvement components of the property class that will bring the improvement component to 100 percent of RMV as part of the overall adjustment.

Outbuildings adjustment—The adjustment factor to apply to the outbuildings component of the property class, which will bring the outbuildings component to 100 percent of RMV as part of the overall adjustment.

Selected ratio explanation—Written reason(s) for the selected ratio. The explanation should discuss why the chosen central tendency best represents the RMV level in the particular property class. If there are other factors that contribute to the support of this measure, they may also be mentioned here.

Valuation history
— Year last appraised for each “market area conclusions and adjustments” page.
— Coefficient of dispersion (COD), for five years if available. A COD higher than the maximum standard for the property type is an indication of a potential valuation problem.
— Price related differential (PRD), for five years if available. A PRD greater than 1.00 suggests high-value parcels are under appraised, a PRD less than 1.00 suggests high-value parcels are relatively over appraised. As a general rule, except for small samples, the PRD should range between .98 and 1.03.

Study listings
Study listings are a collection of sales or market data that have been analyzed and determined to be adequate for use in the ratio study. This collection of data is usually identified as sales listing array, organized in a standard format (see below), and printed on a computer printout medium. For most individual studies there is a sales listing. For each sale in the listing, the property is identified, classified and a ratio calculated. At the end of the listing are summary statistics developed from the listing.

A description of major components in the standard format is as follows:

• Appraisal area or market area—specific area within the county.
• Account number—could be alphanumeric identifying a specific parcel/property.
• Property class (PC)—A three digit number designating type of property.

Example: 1-0-0 residential vacant or 1-0-1 residential improved.

• Condition code (formerly called reject code)—Identifies which sales have been confirmed and which have not.
  33 Confirmed—Sale from this ratio sales year. Usable in ratio study.
  32 Confirmed—Sale from prior ratio sales year. Usable in ratio study.
  31 Unconfirmed—Sale from prior ratio sales year. Usable in ratio study.
  00 Unconfirmed—Sale from this ratio sales year. Usable in ratio study.

In the current study, ____ percent of sales used have been confirmed.

Total number of sales countywide:

<table>
<thead>
<tr>
<th>Sales</th>
<th>Used</th>
<th>Confirmed</th>
</tr>
</thead>
<tbody>
<tr>
<td>____</td>
<td>____</td>
<td>__________</td>
</tr>
</tbody>
</table>

• Map and tax lot—Locates the property in the county. Sales that include more than one account display an asterisk (*) after the tax lot number. The other accounts may be found by referencing the multiple account list at the end of this report.
• Instrument number—The recording number that identifies the sale document.
Preparing the ratio study

- **Total value**—This is usually the real market value from the current certified assessment roll. In some cases it is the value that would have been on the roll although the property has changed. Examples of such changes include construction of buildings and consolidation with other tax lots.

- **Time trend**—A percent adjustment for time made to a sale price. Trends are discussed and calculated in the trend study section of this report.

- **Adjusted sale price**—The estimated sale price for the property if it were to sell January 1, assessment date for the current study.

- **Sale number**—Within each sales listing array the sales are ordered by ratio and each is then identified with a number beginning with the smallest ratio. If one sale appears in two different listings, it will usually have a different sale number in that listing.

- **Ratio**—A comparison of the real market value on the certified roll, to the sale price or adjusted sale price expressed as a percentage. This expresses the real market value level as of the date of sale or as of the January 1 assessment date, if the sales prices were adjusted for time to January 1 for the current year.

  **Example:** current real market value on the certified roll $95,000 (as of the January 1 assessment date) —Sold the following May for $100,000

  $95,000 ÷ $100,000 = .95

  The ratio of 95 percent represents the level of value as of the May sale date.

- **Statistics summary** is found at the end of each study listing.

- **Statistics of central tendency**—Measures of the center, middle, or typical element in a grouping of data. These tendencies measure or reflect the real market value level as represented by this group of data. Questions that could be answered by this information may be, “Are values at 100 percent of real market value?” and, “How much must the values be raised or lowered to bring them to 100 percent of real market value?”

  **Median**—the ratio value with the same number of ratios above as below. Listings that display sizable gaps near their center have unreliable medians.

  **Arithmetic mean**—traditionally called the average. For listings, this is the sum of the ratios divided by the number of ratios.

  Ratios of sales ÷ number of sales

  $ (57+64+76+80+82+93+95+96) ÷ 8 = 80.375 rounded to 80

  The arithmetic mean is distorted by extremely high or low ratios.

  **Geometric mean**—Similar to the median ratio which is not affected by extreme influences. The –nth root of the product of the ratios, where n is the number of ratios in the array.

- **Statistics of distribution**—Methods for showing how values are spread out in the array. In the case of sales listings, distribution means “how far ratios are from a central tendency.” Distribution is a reflection of the RMV levels and the relative stability of the market. Drawing conclusions about distribution from inadequate samples is extremely unreliable.

  **Frequency distribution**—A visual aid used to display how the ratios are distributed; shows the concentration of ratios within certain brackets or intervals, which gives an indication of the degree of uniformity.

---

**Excel Formula for nth Root (Geomean)**

The following is the general form of the equation

\[ \text{num}^{\frac{1}{n}} \]

where "num" is the number you want to find the root of and "n" is the count.

**Example**

To find the nth root of a number, raise that number to the power of 1/n.

For example, to find the cube root of 8 in a cell, type the following:

\[ =8^{(1/3)} \]

Answer: 2

**OR, as above:**

\[ =.154259^{(1/8)} \]

Answer: 0.79

**Weighted mean**—The sum of the total prior year RMVs divided by the sum of the adjusted sales prices or sales prices.

<table>
<thead>
<tr>
<th>Prior year values</th>
<th>Adjusted sales price</th>
</tr>
</thead>
<tbody>
<tr>
<td>$48,420</td>
<td>$75,000</td>
</tr>
<tr>
<td>$96,020</td>
<td>$129,500</td>
</tr>
<tr>
<td><strong>$144,440</strong></td>
<td><strong>divide by $204,500</strong></td>
</tr>
</tbody>
</table>

Extremely high/low assessed values or sales prices will have the most effect on this measure.
Preparing the ratio study

**Average deviation**—Average of the absolute differences between each ratio and the “median.”

**Coefficient of dispersion (COD)**—The average deviation from the “median” converted to a percentage. This measure of appraisal equity has taken on a greater role in the management of the appraisal program. Helps alert and guide the assessor as to uniformity of real market value levels and may direct decisions for revaluation or special studies.

**Standard deviation**—Measure of deviation from the arithmetic mean (“average”) for a normally distributed population.

**Coefficient of variance (COV)**—The standard deviation from the arithmetic mean (“average”) converted to a percentage.

**Price related differential (PRD)**—The measure of systematic differences in mass-appraisal value levels among properties in the same market area. The PRD is a statistical operation for measuring vertical equity. It is calculated by dividing the mean by the weighted mean. Optimally, appraisals made for property tax purposes would be neither regressive nor progressive. This statistical indication should be close to 100.

**Regressive**—When low-value properties are appraised at greater percentages of market value than high-value properties.

**Progressive**—When low-value properties are appraised at smaller percentages of market value than high-value properties.

**PRD = arithmetic mean ÷ weighted mean**

**95 percent confidence interval**—A test, if repeated many times. In 95 percent of such tests, the actual population mean will be in the indicated interval. This approximates the common interpretation that there is a 95 percent chance that the mean is in the specified interval. A narrow interval indicates that the mean may be taken as a reliable estimate of the correct figure.

Confidence interval 95% = mean + / 1.96 × standard deviation

Square root of (sample size)

**Recalculated values**—Not all RMVs are adjusted or indexed as described above. Specially assessed property, personal property, and many industrial properties are recalculated each year. This ratio study format does not report on values being recalculated. However, it does report on how RMVs will be adjusted for farm and forest deferred properties.

**County map and maps of market areas as appropriate**
Basic property class codes

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-0-0</td>
<td>Residential land only.</td>
<td>1-0-1</td>
<td>Residential property.</td>
</tr>
<tr>
<td>2-0-0</td>
<td>Commercial land only.</td>
<td>2-0-1</td>
<td>Commercial property.</td>
</tr>
<tr>
<td>3-0-0</td>
<td>Industrial land only.</td>
<td>3-0-1</td>
<td>Industrial property county.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3-0-1 DOR</td>
<td>Industrial property DOR.</td>
</tr>
<tr>
<td>4-0-0</td>
<td>Tract land only.</td>
<td>4-0-1</td>
<td>Tract property.</td>
</tr>
<tr>
<td>5-0-0</td>
<td>Farm &amp; range land only, not specially assessed.</td>
<td>5-0-1</td>
<td>Farm &amp; range property not specially assessed.</td>
</tr>
<tr>
<td>5-4-0</td>
<td>Non-EFU zone land, which is under special assessment by application.</td>
<td>5-4-1</td>
<td>Non-EFU zone farm and range property under special assessment farm use assessment by application.</td>
</tr>
<tr>
<td>5-5-0</td>
<td>EFU-zoned farm &amp; range land only, specially assessed.</td>
<td>5-5-1</td>
<td>EFU-zoned farm &amp; range property, specially assessed and market.</td>
</tr>
<tr>
<td>6-0-0</td>
<td>Forestland only, classified and specially assessed.</td>
<td>6-0-1</td>
<td>Forest property specially assessed and market.</td>
</tr>
<tr>
<td>6-4-0</td>
<td>Forestland only designated by application.</td>
<td>6-4-1</td>
<td>Forest property designated by application, specially assessed and market.</td>
</tr>
<tr>
<td>7-0-0</td>
<td>Multifamily land only.</td>
<td>7-0-1</td>
<td>Multifamily property.</td>
</tr>
<tr>
<td>8-0-0</td>
<td>Recreation land only.</td>
<td>8-0-1</td>
<td>Recreation property.</td>
</tr>
<tr>
<td>0-0-0</td>
<td>Miscellaneous land only.</td>
<td>0-0-9</td>
<td>Real property manufactured structures.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0-1-9</td>
<td>Personal property manufactured structures.</td>
</tr>
</tbody>
</table>

Property class codes listing and description ORS 308.215 and OAR 150-308.215(1).
(If different than state property class codes, provide a cross-reference listing.)

Change ("time") trend analysis

for the January 1, 20—Assessment Date

Suggestions of items to include:

• Trend studies:
  • Resales, regression, other
  • Trend conclusions:
    Residential, commercial, other
  • Graphs:
    Sales activity (monthly, quarterly, etc.)
    Sales history
### Preparing the ratio study

**Year:** _____  **Certified ratio study**  
**County**  
**Property type/class code** ________________________________

<table>
<thead>
<tr>
<th>Market area/unit type (appraisal area/study area)</th>
<th>Study name (description/codes/number)</th>
<th>Page #</th>
<th>Adjustments</th>
<th>After ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Land</td>
<td>Site</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
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<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

**Summary of adjustments & (after ratios)**

**If all after ratios are 100 and documented on the “certification” page**

**Date _____ / _____ / _____**  
**(multiple pages)**  
**Page _____**
### Market area conclusions and adjustments

**Property class/type:** Market area name/number/code or unit type: ____________________________

**Location/description information:**

---

### ADJUSTMENT CALCULATION SUMMARY:

#### Sample size

Population of accounts/units number of sales approximate sample size _____%  

#### Weighting calculations (for improved property types only)*

<table>
<thead>
<tr>
<th>Values on roll</th>
<th>Prior year RMV sample or roll</th>
<th>Weight of sample or roll</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land</td>
<td>$ ____________</td>
<td>____________ %</td>
</tr>
<tr>
<td>On-sites</td>
<td>$ ____________</td>
<td>____________ %</td>
</tr>
<tr>
<td>Improvements</td>
<td>$ ____________</td>
<td>____________ %</td>
</tr>
<tr>
<td>Other (outbuildings)</td>
<td>$ ____________</td>
<td>____________ %</td>
</tr>
<tr>
<td>Total</td>
<td>$ ____________</td>
<td>____________ %</td>
</tr>
</tbody>
</table>

#### Ratio selections & adjustment factors  

**Selected ratio from array:**

**Time trend factor:**

**RMV before ratio:**

- Overall adjustment factor:
- Land adjustment factor:
- On-site adjustment factor:
- Improvement adjustment factor:
- Other adjustment factor:

**After ratio:** ____________ %  

---

* Weighting calculations may be based on the market area roll population (% of land, on-sites, improvements and other outbuildings) or the sales listing sample (% of land, on-sites, improvements and other outbuildings). Some counties weight land and on-sites together and (or) improvements and other outbuildings together.

**If sale prices are not adjusted to the January 1 assessment date.

(continues on next page)
Preparing the ratio study

Selected ratio explanation: __________________________________________________________

_____________________________________________________________________________

_____________________________________________________________________________

_____________________________________________________________________________

_____________________________________________________________________________

_____________________________________________________________________________

Valuation history

Year last appraised ________________

<table>
<thead>
<tr>
<th>History</th>
<th>200__</th>
<th>200__</th>
<th>200__</th>
<th>200__</th>
<th>200__</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coefficient of dispersion (COD)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Price-related differential (PRD)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Date _____ / _____ / _______ 

Page ______
Sales listings and statistics

Sales ratio arrays in ascending order

Frequency distribution

Central tendencies and related statistics

- Median
- Average deviation
- Coefficient of dispersion

- Arithmetic mean
- Standard deviation
- Coefficient of variation

- Weighted mean
- Price-related differential

Additional measures of central tendency

- Geometric mean
- Mode
Preparation the ratio study

Appraisal/valuation plan

for January 1, 20____ and/or 20____

Explanation of appraisal/revaluation activities planned for market areas not trended.

Other formats containing this information may be submitted.

Areas planned for appraisal/revaluation:

Reasons:

Objectives:

Method of appraisal:

Target performance measures:
As part of the appraisal plan, please complete the form below for market areas where coefficients of dispersion are borderline in the current year and two prior years’ ratio studies.

<table>
<thead>
<tr>
<th>Market area</th>
<th>Property case/type</th>
<th>COD prior years</th>
<th>Ratio of MAV of unchanged properties to RMV current and prior years</th>
<th>% of accounts where RMV=AV current and prior year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>200</td>
<td>200</td>
<td>200 200 200</td>
<td>200 200</td>
</tr>
</tbody>
</table>
Statistical Notation:

Subscripts of $x_{ij}$  $x_{ijk}$

Summations $\sum$

Brackets $\{\}[]$

$\sum_{i=1}^{6} x_{i}$

$(\sum_{i} x_{i})^{2}$

$\sum_{i} (\sum_{j} x_{ij})^{2}$
Subscripts $x_i$

$x_i$. The subscript $i$ means that $x$ can take on different $i, j, k, l$ or #1, 2, 3, 4. A particular value of $i$, tells which form or value of $x$ we are concerned with.

$x_i$. Might be the height of an individual
Subscripts $x_1, x_2, x_3,$
Subscripts $x_1, x_2, x_3, x_4$
Subscripts $x_{ik}$

- In $x_{ik}$ the $i$ might be the characteristic (for height, $i = 1$; for weight, $i = 2$; and for age, $i = 3$)

- The $k$ could be used to designate which individual we are dealing with.

Then $x_{2,7}$ would tell us that we are dealing with the weight ($I = 2$) of the seventh ($k = 7$) individual.
Symbol \( \Sigma \)

Greek letter *sigma*

\( \Sigma \) is used to represent the summation of the values of whatever symbol follows.

\( \Sigma x \) - Tell us to sum up the values of \( x \)

\[
\sum_{i=1}^{6} x_i
\]

\( x \) Tells what is to be summed and the letter above and below \( \Sigma \) indicates the limits over which the subscript \( i \) will be allowed to vary. This tells us to sum all values of \( x_i \), letting \( i \) go from 1 up to 6.

*Note: When there is no notation below or above the summation sign, it means sum all.*
When other operations are to be performed along with the addition, some form of bracketing may be used to indicate the order of operations for example.

\[ (\sum x_i)^2 \]

 Says add all the \( x_i \) values, then square the sum.

\[ \sum_{i=1}^{n} x_i^2 \]

 Says square each \( x_i \) value, then add up these squared values.
Mean or Average

- $\mu$. The $\text{Mean} \div \text{Average}$ of the population

- $\bar{x}$. The $\text{Mean} \div \text{Average}$ of the sample
Absolute Values

$|3| = 3$

$|-3| = 3$
$X_1 X_2 X_3 X_4 \ldots X_n$

This means continue till all the unknown are included.
Adjusting sales
by curvilinear regression analysis
on the trend of the sales ratios

August 21, 2002

Dave Jacobs,
DOR
## Table of Contents

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<tr>
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<th>Page</th>
</tr>
</thead>
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</tr>
<tr>
<td>PowerPoint presentation</td>
<td>3</td>
</tr>
<tr>
<td>Procedure for curvilinear time analysis</td>
<td>13</td>
</tr>
<tr>
<td>R-squared (from Microsoft)</td>
<td>20</td>
</tr>
<tr>
<td>Class exercises</td>
<td>21</td>
</tr>
</tbody>
</table>
Discussion

In real estate, one thing is constant—and that thing is change. Change complicates estimates of market value. When asked for an estimate of value, the first question of an astute appraiser is “as of which date?” Since sales of property comparable to the subject seldom occur on the effective date of the appraisal, the appraiser ponders: What difference in value can be attributed to change in the market since the comparable property sold? In mass appraisal, an analysis of market change (time analysis) is essential not only for ratio programs, but also for revaluation through recalculation or reappraisal. Sales must be adjusted to a base date.

The time analysis for recalculation or reappraisal should be done independently from the county’s ratio program. In the ratio program, time analysis results in the adjustment of sales or of ratios. If the county regularly adjusts ratios, then the sales still have to be adjusted to do any other stratification, recalculation, or reappraisal. Even if the county adjusts their sales for the ratio program, the appraisal staff will want to conduct their own time analysis for reappraisal, since the selection of usable sales will be different from the ratio study. The time analysis for recalculation or reappraisal will result in the adjustment of the usable sales.

A type of time analysis that readily lends itself to mass appraisal is to measure the change or trend in ratios over time. Remember, (in Oregon) the sales ratio is the real market value (RMV) divided by the sales price. Since the RMV doesn’t change over the period being measured, all change in the ratios is attributed to change in the sales price. If your time analysis spans periods in which RMV has been adjusted (trended) you must use the most current RMV even though the sale occurred in the period using the former RMV.

Analyzing the change in the ratios for time analysis has many advantages over other techniques:

- Since a massive amount of data is used in measuring the change in ratios, the chance of an individual sale biasing the measurement is reduced compared to techniques that utilize resales or reappraisals.
- Also, through utilization of computer spreadsheet programs that plot the changes in the ratio, curvilinear analysis is possible.
- Curvilinear regression of the trend of the ratios is significant because a change in the natural world is seldom linear, especially over longer time periods.

In this unit, we will teach techniques for utilizing curvilinear regression of the ratio trend line in Excel. To master this technique, familiarization with Excel’s graphing tool is paramount.
PowerPoint Presentation:

Slide 1

Time Adjustment Through Curvilinear Regression of the Trend of the Sale Ratios

Slide 2

To Err is Human.
But to Really Screw Up You Need a Computer!
Slide 3

Time Adjustments?????

“Time itself is not the cause for the adjustment, it is the movement of value over time. The adjustment change is expressed as a percentage of increase or decrease to sales prices to reflect what the property should have sold for as of the assessment date.” — Assessor’s Certified Ratio Study Procedures Manual

Slide 4

Types of Time Analysis

The Ratio Manual Recognizes the Following Methods:

1. Ratio Trend Analysis.
2. Regression Analysis.
3. Double Sales Analysis.

However, regression analysis is the technique that is generally used in conjunction with ratio trend analysis.
Slide 5

**Double Sales Analysis**

Simply described, this technique utilizes properties which have sold twice and compares the difference in sales prices. The difference is attributed to changes in the market since the property first sold.

**Issues:**

1. Difference attributed to externalities. Could it be that there have been changes to the property which may cause some of the difference if value?
2. Adjustments based on small amount of data.

Slide 6

**Ratio Trend Analysis**

Simply stated, this technique compares the differences in the ratio between periods and attributes that change to changes in price from one period to the next.

**Issues:**

1. Difficult to comprehend - Since ratio is RMV/Price, the trend of the ratio is the inverse of the trend of the sale prices. Also, some of the regression techniques employ advanced math.
2. May be no clear central tendency for time period.
Example of trend of the ratios: Linear Regression

Slope - Intercept Formula for a Straight Line: \( y = ax + b \)

In the slope-intercept formula “X” is the independent variable and “Y” is the dependant variable.

“b” is the point where the line intercepts the Y axis when \( X = 0 \), it is called the Y intercept.

“a” is the rate of change of Y for every unit of X, it is called the slope.

Underlying assumption: change of the trend of the ratio is constant and in the same direction.

Calculating The Slope of a Straight Line (a)

Definition of slope: the rate of change of y for every unit of x.

\[
a = \text{Slope} = \frac{\Delta y}{\Delta x}
\]

\( \Delta \) Means change in a variable
Remember

**Remember** the ratio is the RMV ÷ Sales Price.

**Therefore,** the ratio is the RMV expressed as a percentage of the sales price.

**For example,** a ratio of 70 means that the RMV is 70% of the sales price.

**Also,** there is an inverse relationship between the ratio and the sales price. As sale prices increase, the ratio will decrease. As sale prices drop, the ratio will increase.

The calculation of the slope of the ratio trend line can be visualized as follows:

\[ \text{Slope} = a = \frac{\Delta y}{\Delta x} = \frac{y_1 - y_2}{x_1 - x_2} = \frac{98 - 90}{2 - 10} = \frac{8}{-8} = -1 \]

This means **that for every month added, the ratios decrease by 1%.**

Or since the RMV’s are static, the variables that are changing are the sales prices. Hence, this means **that for every month added, the sales prices increases 1%.**
Linear Regression:

An effective method of adjusting for time involves linear regression. It must be emphasized that this method assumes that property values change by a constant percentage each month. This method may be viable for a relatively short period of time, such as a ratio year. Over longer periods of time, or in a rapidly changing or unusual market, it may be necessary to use nonlinear adjustment factors.

In example, for linear regression, the sales would be adjusted up 0.3% for each quarter. First quarter sales would be adjusted by 0.9%, second quarter by 0.6%, and so forth.

What if the majority of the sales are in the second and third quarters? The graph indicates that those quarter sales should be adjusted down to make the January 1st ratio level.

Yet, using the linear model, we are adjusting those sales up: 0.6 for second quarter and 0.3 for second quarter.
Curvilinear Process

1. Analyze available sales and determine the appropriate time period to use for sale central tendencies.

2. Calculate central tendencies of the ratios for the time periods and determine which one is best for period.

3. Graph selected central tendency ratio against period on a scatter plot.

4. Determine the relationship between ratio and period which best fits the data. Utilize the $r^2$ calculation.

5. Calculate the “curve ratio” for each period of time.

6. Determine the multiplier which will adjust the sales to the desired date. It is the curve ratio for that period divided by the curve ratio for the last period.

Slide 14

1. Analyze available sales and determine the appropriate time period to use for sale central tendencies.

   Month?
   Quarter?
   Semester?
2. Calculate central tendencies of the ratios for time periods and determine which one is best for period.

- Mean??
- Median??
- Geometric Mean??
- Weighted Mean??

3. Graph selected central tendency ratio against period on a scatter plot.

<table>
<thead>
<tr>
<th>Quarter</th>
<th>Average</th>
<th>Median</th>
<th>Geo Mean</th>
<th>Selected</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>99</td>
<td>102</td>
<td>99</td>
<td>99</td>
</tr>
<tr>
<td>2</td>
<td>97</td>
<td>97</td>
<td>97</td>
<td>97</td>
</tr>
<tr>
<td>3</td>
<td>97</td>
<td>98</td>
<td>97</td>
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</tr>
<tr>
<td>4</td>
<td>98</td>
<td>98</td>
<td>98</td>
<td>98</td>
</tr>
</tbody>
</table>

\[ y = 0.75x^2 - 4.05x + 102.25 \]
\[ R^2 = 0.9818 \]
4. Determine the relationship between ratio and period which best fits the data. Utilize \( r^2 \) (the square of “Pearson Product Moment Correlation”).

<table>
<thead>
<tr>
<th>PC 400, 500 &amp; 800</th>
</tr>
</thead>
<tbody>
<tr>
<td>y = 0.75x^2 - 4.05x + 102.25</td>
</tr>
<tr>
<td>( R^2 = 0.9818 )</td>
</tr>
</tbody>
</table>

5. Calculate the “curve ratio” for each period of time.

Curve Ratio \((y) = 1.25x^2 - 6.55x + 105.25\)

<table>
<thead>
<tr>
<th>Quarter</th>
<th>Average</th>
<th>Median</th>
<th>Geo Mean</th>
<th>Selected</th>
<th>Curve Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>99</td>
<td>102</td>
<td>99</td>
<td>99</td>
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</tr>
<tr>
<td>2</td>
<td>97</td>
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<td>3</td>
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<td>97</td>
</tr>
<tr>
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<td>98</td>
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</tr>
</tbody>
</table>
6. Determine the multiplier which will adjust the sales to the desired date.

It is the curve ratio for that period divided by the curve ratio for the last period.

<table>
<thead>
<tr>
<th>Quarter</th>
<th>Average</th>
<th>Median</th>
<th>GeoMean</th>
<th>Selected Curve Ratio</th>
<th>Adj Sales</th>
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<tr>
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<td>98</td>
<td>98</td>
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<td>98</td>
<td>98</td>
</tr>
</tbody>
</table>
Procedure for Curvilinear Time Analysis

1. Analyze available sales and determine the appropriate period to use for sale central tendencies.
   A. The fewer the sales, the larger the periods.
   B. Try to use at least five sales per period. You may have to expand the population to get the necessary sales—combine property classes or areas.
   C. If sales are very sparse, may consider using two years of sales data. If using two years of sales data, the RMV used to calculate the sales ratio will be for the last year for both years of sales data.

2. Calculate central tendencies of the ratios for the periods and determine which one is best for period.
   a. In Excel, an “If” statement using an array formula works well to automate the calculation of the central tendencies: mean, median, and geometric mean.

   i. With the cursor in the first data cell under “Mean,” left click the mouse to highlight the cell to begin entering the array formula.
   ii. Enter the formula without spaces: =AVERAGE(IF($O$2:$O$805=$P2,$L$2:$L$805)).
   iii. The expression “$O$2:$O$805” is the range of the “Period” column.
   iv. The expression “$P2” is the first entry in the “Month” column. The “$” in front of the “P2” permits the copying of the formula to other cells.
   v. The expression “$L$2:$L$805” is the range of the “Ratio” column.
   vi. This formula averages all of the ratios in the column L rows 2 through 805, when the Period (column O) is equal to the Month (column P), for all periods in the column O rows 2 through 805.
   vii. Hold down both control (ctrl) and the shift keys while hitting the enter key. This should add {} around the formula just entered.
   viii. The resulting number should equal the average of all sales ratios occurring within period number 1.
   ix. To copy this formula down for the rest of the sales months: Just point the cursor at the small box at the left bottom corner of the cell with the formula until the cursor turns into a solid black cross, then click and drag it down to the cell just even with the cell with the month 12.
   b. The median and the geometric mean can be calculated by just copying and pasting.
   c. Next to the “Geomean” column, place a header and call it “Selected.” For each month determine the best central tendency and place it in the “Selected” column. I like to highlight with a color the central tendency I have selected.

3. Graph the selected central tendency ratio against period on a scatter plot.
   a. Click on the “Chart Wizard” icon.
   b. In the Chart Wizard—step 1 of 4 window, under “chart type” select “XY (Scatter).”
   c. Under “chart sub-type” select the first one that should be “Scatter, compares pairs of values”.
   d. Click “Next.”
e. In the Chart Wizard—step 2 of 4 window, click on the “series” tab.
f. In the “Series” list that appears in the lower left of window, delete all series that the dumb machine suggested. Selecting a series and clicking the “remove” button does this.
g. Add a series by clicking the “Add” button.
h. Click in the “Name” input area and type “Selected Ratio.”
i. Click in the “X Values” input area. Notice that the series name changes in the “Series” box to Selected Ratio and the graph title and legend changes to Selected Ratio.

j. Click on the minimize window icon (right side of “X Values:” input area). Select all the month indications.
k. Click the maximize window icon (right side of “X Values:” input area). Notice that the range names for the months have been entered.
l. Click in the “Y Values:” input area and then click on its minimize window icon. Then select all the selected ratios. Maximize the window by clicking the icon on the right side of the input area.
m. Click “Next.”
n. In the Chart Wizard—step 3 of 4 window, click on the “Titles” tab and remove all the titles that the dumb machine suggested. Selecting and deleting does this.

o. For “Chart title” type in Selected Ratio by Month. For “Value (X) Axis” type in Month. For “Value (Y) Axis” type in Selected Ratio.

p. Next, click on the “Legend” tab. If a legend is chosen, deselect it by checking in the box.

q. Click on “Next.”
4. Determine the relationship between ratio and period which best fits the data. Utilize the $r^2$ calculation as an indication which relationship best fits the data.

a. For the data series, click on a data point not on a grid line. Select “Add Trendline.” Click on the “Type” tab. Select “linear” by clicking on the linear picture.

r. In the Chart Wizard—step 4 of 4 window, select the radio button for “As object in:”. This places the chart on the same worksheet where your data resides. The “As new sheet:” places the chart its own worksheet.

s. Click “Finish.” The dumb machine always places the chart over the data. You can click and drag the chart wherever you wish and you can size the chart to a size comfortable for you.
b. Click on the “Options” tab. Click in the box for “Display Equation on Chart” and “Display R\(^2\) Value on Chart.” Click “OK.”

c. Determine the best-trend line for the selected ratios in the following manner:
   
i. First, note the r\(^2\) value of the linear trend line.
   
ii. Right click on the trend line and then click on “Format Trendline.”
   
iii. Click on the “Type” tab.
   
iv. Choose the next type of line (linear, logarithmic, polynomial, power, or exponential. **Note:** Do not choose moving average or you will lose your formula and R\(^2\) value.

   v. Click “OK.” Then note the changed r\(^2\) value. If the r\(^2\) value has increased over the first trend line, the data fit of the line has improved. **Warning:** If you choose a polynomial fit above the third order, Excel may not return the proper formula for the indicated trend line. In this situation,
you should graph the indicated curve points developed by the formula to see if they are really on the curve. See step #5 to determine points on curve using the formula.)

vi. Try all the relationships (except for moving average) by repeating steps C2 through C5 above. The type of relationship between x & y that returns the highest \( r^2 \) value will fit the data the best. However, be judicious in this determination. There are some conditions that would warrant the choice of a lesser \( r^2 \) value in favor of a more realistic curve.

5. Calculate the “curve ratio” for each period. Excel will return a formula for the trend line for linear, logarithmic, polynomial, power, and exponential relationships. Using that formula, calculate the value for \( y \) (curve ratio) for each value of \( x \) (period).
   a. Click in the text box with the formula and then select the formula starting with the “=” sign. In the menu, select Edit. Then select copy.
   b. Place your cursor in the first cell under the “Curve” column. In the menu, select Edit. Then select paste.
   c. Edit the formula in the formula box.
      i. Make certain there are no spaces between the “=” sign and the first beginning of the formula.
      ii. Replace all “x” with the cell reference for the first period.
      iii. Make certain that the proper math functions are indicated. For example 0.1715M6 should become 0.1715*M6. (Where M6 is the cell reference.)
   iv. If the formula calls for power make certain it is indicated with a “^” (caret). For example 0.1715x3 would become 0.1715*(M6^3). (Where M6 is the cell reference.)
   v. Some functions may call for use of the “paste function” tool. For information see Student Manual, page 6-10, step 7C2.
   vi. When completed, press enter.
   d. Copy down for all periods.

6. Determine the multiplier, which will adjust the sales to the desired date. Although the desired date is usually January 1 of the year following the sales collection, the closest we get to it with this technique is to adjust to the midpoint of the last period. The sales adjustment is determined with a simple mathematical calculation. Just divide the curve ratio for each period by the curve ratio for the last period.
Class Exercises:

1. Load Excel file SIE Exercise 2-1.xls
2. Label second tab “Adj. Sales.”
3. Copy sales from “Good Sales” tab to “Adj. Sales” tab.
4. In “Adj. Sales” tab, separate by PC groups—use filter First P. Class group “100” & “400.”
5. Copy P. Class groups to second tab and name “Time calc.” Start in cell A2.
6. In cell A1 type: PC 100 & 400.
7. Sort by sale date.
10. In cell A30 type PC 101 & 401.
11. Calculate time adjustment for PC 100 & 400.
   a. Insert quarter column in column E.
   b. Assign quarter to each sale in column E.
   c. Sort by quarter in first key and by ratio in second key.
   d. Move to right of data (cell L2) and create a header “Quarter.”
   e. Under quarter (column L) data fill 1-4.
   f. In cell M2 type header count. In cell N2, type header average. In cell O2, type header median.
   g. In cell M3, under “Count” header, type in array formula for count: =count(if($E$3:$E$19=$L3,$J$3:$J$19)).
   h. Use control–shift–enter.
   i. Copy cell M3 down for each period (quarter) in column L. Copy cell M3 across to cells N3, O3, and P3.
   k. Copy cell N3 down for each period (quarter) in column L.
   l. In cell O3 replace count with median—use control–shift–enter.
   m. Copy cell O3 down for each period (quarter) in column L.
   n. In cell P3, replace count with geo mean—use control–shift–enter.
   o. Copy cell P3 down for each period (quarter) in column L.
   p. In selected column, determine (evaluate) and place in column the central tendency that best represents the data for each quarter.

RSQ

See Also

Returns the square of the Pearson product moment correlation coefficient through data points in known_y's and known_x's. For more information, see PEARSON. The r-squared value can be interpreted as the proportion of the variance in y attributable to the variance in x.

Syntax

RSQ(known_y's, known_x's)

Known_y's is an array or range of data points.
Known_x's is an array or range of data points.

Remarks

- The arguments must be either numbers or names, arrays, or references that contain numbers.
- If an array or reference argument contains text, logical values, or empty cells, those values are ignored; however, cells with the value zero are included.
- If known_y's and known_x's are empty or have a different number of data points, RSQ returns the #N/A error value.
- The equation for the r value of the regression line is:

\[ r = \frac{n\overline{XY} - (\overline{X})(\overline{Y})}{\sqrt{[n\overline{X}^2 - (\overline{X})^2][n\overline{Y}^2 - (\overline{Y})^2]}} \]

Example

RSQ({2, 3, 9, 1, 8, 7, 5}, {6, 5, 11, 7, 5, 4, 4}) equals 0.05795
q. Place cursor outside of data (cell L8 would do). Select chart wizard and scatter with no connecting lines.

r. Create graph using 4 quarters and lineal curve fit—include R² and formula.

s. Change graph to polynomial curve at 2nd Order. Also check out results ranging to 4th order and determine which to use.

t. In the “Curve Ratio” column, copy the formula for the curve and copy down for each quarter.

u. In the “Sales Adj.” column, calculate the sales adjustment for each quarter. This is the multiplier of the sales for each quarter that brings the ratio to the fourth quarter’s level. It is the curve ratio for the period (quarter) divided by the curve ratio for the last period (quarter).

12. On the “Adj. Sales” tab, adjust PC 100 and 400 sales prices.
   a. Turn off filter if active (must restore database first) and insert adj. sales column.
   b. Turn filter back on and filter for property classes 100 and 400.
   c. Sort by sales date.
   d. Apply time adjustment to sales in adj. sales column.

13. (Students to do following by themselves.) Go through same process determining time adjustment for PC 101 & 401.
   a. Use month instead of quarter for period indicator.
(Handout #1)
Statistical notation:
Subscripts, Summations, and Brackets

Taken from Elementary Forest Sampling (U.S. Department of Agriculture Handbook No. 232).

In describing the various sampling methods, frequent use will be made of subscripts, brackets, and summation symbols. Some beginning samplers will be unhappy about this; others will be downright mad. The purpose though, is not to impress or confuse the reader. These devices are, like the more familiar notations of +, -, and =, merely a concise way of expressing ideas that would be ponderous if put into conventional language. And like the common algebraic symbols, using and understanding them is just a matter of practice.

**Subscripts.** The appearance of \( x_i, z_{jb}, \) or \( y_{i1m} \) brings a frown of annoyance and confusion to the face of many a forester. Yet interpreting this notation is quite simple. In \( x_i \), the subscript \( i \) means that \( x \) can take on different forms or values. Putting in a particular value of \( i \) tells which form or value of \( x \) we are concerned with. The \( i \) might imply a particular characteristic of an individual. The term \( x_1 \) might be the height of the individual, \( x_2 \) might be his weight, \( x_3 \) his age, and so forth. Or the subscript might imply a particular individual. In this case, \( x_1 \) could be the height of the first individual, \( x_2 \) the height of the second, \( x_3 \) the height of the third individual, and so forth. Which meaning is intended will usually be clear from the context.

A variable (say \( x \)) will often be identified in more than one way. Thus, we might want to refer to the age of the second individual or the height of the first individual. This dual classification is accomplished with two subscripts. In \( x_{k} \) the \( i \) might identify the characteristic (for height, \( i = 1 \); for weight, \( i = 2 \); and for age, \( i = 3 \)). The \( k \) could be used to designate which individual we are dealing with. Then \( x_{27} \) would tell us that we are dealing with the weight \( (i = 2) \) of the seventh \( (k = 7) \) individual. This process can be carried to any length needed. If the individuals in the above example were from different groups we could use another subscript (say \( j \)) to identify the group. The symbol \( x_{j3k} \) would indicate the \( j^{th} \) characteristic of the \( k^{th} \) individual of the \( j^{th} \) group.

**Summations.** To indicate that several (say 6) values of a variable \( (x_i) \) are to be added together we could write:

\[
(x_1 + x_2 + x_3 + x_4 + x_5 + x_6)
\]

A slightly shorter way of saying the same thing is:

\[
(x_1 + x_2 + \ldots + x_6)
\]

The three dots (\( \ldots \)) indicate that we continue to do the same thing for all the values from \( x_3 \) through \( x_5 \) as we have already done to \( x_1 \) and \( x_2 \).
The same operation can be expressed more compactly by:

\[ x_{i} = \sum_{i=1}^{6} x_{i} \]

In words this tells us to sum all values of \( x_{i} \), letting \( i \) go from 1 up to 6. The symbol \( \sum \), which is the Greek letter sigma, indicates that a summation should be performed. The \( x \) tells what is to be summed and the letter above and below \( \sum \) indicates the limits over which the subscript \( i \) will be allowed to vary.

If all of the values in a series are to be summed, the range of summation is frequently omitted from the summation sign giving:

\[ x \]

All of these imply that we would sum all values of \( x_{i} \).

The same principle extends to variables that are identified by two or more subscripts. A separate summation sign may be used for each subscript. Thus, we might have:

\[ x_{y, i} = \sum_{i=1}^{3} \sum_{j=1}^{4} x_{i,j} \]

This would tell us to add up all the values of \( x_{y} \) having \( j \) from 1 to 4 and \( i \) from 1 to 3. Written the long way, this means:

\[ (x_{1,1} + x_{1,2} + x_{1,3} + x_{1,4} + x_{2,1} + x_{2,2} + x_{2,3} + x_{2,4} + x_{3,1} + x_{3,2} + x_{3,3} + x_{3,4}) \]

As for a single subscript, when all values in a series are to be summed, the range of summation may be omitted, and sometimes a single summation symbol suffices. The above summation might be symbolized by:

\[ x_{y, i, j}, \quad x_{y, i,j}, \quad x_{y, i}, \quad x_{y, i,j}, \quad x_{y}, \quad x_{y}, \quad x_{y}, \quad or \quad maybe \quad even \quad x \]

If a numerical value is substituted for one of the letters in the subscript, the summation is to be performed by letting the letter subscript vary but holding the other subscript at the specified value.

As an example,

\[ x_{3,j} = (x_{3,1} + x_{3,2} + x_{3,3} + x_{3,4}) \]

and,

\[ x_{i,2} = (x_{1,2} + x_{2,2} + x_{3,2} + x_{4,2} + x_{5,2}) \]
Bracketing. When other operations are to be performed along with the addition, some form of bracketing may be used to indicate the order of operations for example,

$$x_i^2$$

tells us to square each value of $x_i$ and then add up these squared values. But

$$\sum_{i} x_i^2$$

tells us to add all the $x_i$ values and then square the sum.

The expression

$$x_{ij}^2$$

says to square each $x_{ij}$ value and then add the squares. But

$$\sum_{i} \sum_{j} x_{ij}^2$$

says that for each value of $i$ we should first add up the $x_{ij}$ over all the values of $j$. Next, this

$$\sum_{j} \sum_{i} x_{ij}^2$$

is squared and these squared sums are added up over all values of $i$. If the range of $j$ is from 1 to 4 and the range of $i$ is from 1 to 3, then this means:

$$\sum_{i=1}^{3} \sum_{j=1}^{4} x_{ij}^2 = (x_{1,1} + x_{1,2} + x_{1,3} + x_{1,4}) + (x_{2,1} + x_{2,2} + x_{2,3} + x_{2,4}) + (x_{3,1} + x_{3,2} + x_{3,3} + x_{3,4})$$

The expression

$$\sum_{i} x_{ij}^2$$

would tell us to add up the $x_{ij}$ values over all combinations of $i$ and $j$ and then square the total. Thus,

$$\sum_{i=1}^{3} \sum_{j=1}^{4} x_{ij}^2 = (x_{1,1} + x_{1,2} + x_{1,3} + x_{1,4} + x_{2,1} + x_{2,2} + x_{2,3} + x_{2,4} + x_{3,1} + x_{3,2} + x_{3,3} + x_{3,4})$$
Where operations involving two or more different variables are to be performed, the same principles apply.

\[
\prod_{i=1}^{3} x_i y_i = x_1 y_1 + x_2 y_2 + x_3 y_3
\]

But,

\[
\prod_{i=1}^{3} x_i \sqrt{\prod_{i=1}^{3} y_i} = (x_1 + x_2 + x_3)(y_1 + y_2 + y_3)
\]

N.B.: It is easily seen but often forgotten that:

\[
x_i^2 \text{ is not usually equal to } \prod_{i=1}^{2} x_i \sqrt{y_i}
\]

Similarly,

\[
x_i y_i \text{ is not usually equal to } \prod_{i=1}^{2} x_i \sqrt{y_i}
\]

Some practice. If you feel uncomfortable in the presence of this symbology, try the worked examples on page 79.
## PRACTICE PROBLEMS IN SUBSCRIPT AND SUMMATION NOTATION

### Values of the Variable $x_{ij}$

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<thead>
<tr>
<th>$i$ Classification</th>
<th>$j$ Classification</th>
<th>$j = (1, \ldots, 10)$</th>
<th>$i$ Classification subtotals</th>
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<tbody>
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<td>$j = (1, \ldots, 10)$</td>
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<td>$j$ Classification subtotals</td>
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<td>7</td>
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<tr>
<td>$j$ Classification subtotals</td>
<td>18</td>
<td>25</td>
<td>29</td>
</tr>
</tbody>
</table>

### Examples:

1. $x_{1,3} = 2$, $x_{7,5} = 6$, $x_{3,7} = 2$, $x_{4,7} = 0$

\[ X_{i j} = \left( x_{1,1} + x_{1,2} + \ldots + x_{1,10} + x_{2,1} + x_{2,2} + \ldots + x_{7,10} \right) = (6 + 4 + \ldots + 8 + 4 + 8 + \ldots + 3) = 243 \]

2. $x_{i j} = (x_{2,1} + x_{2,2} + x_{2,3} + x_{3,1} + x_{3,2} + x_{3,3})$

\[ = (4 + 8 + 4 + 2 + 3 + 2) = 23 \]

3. $x_{i j} = \left( x_{1,3}^2 + x_{1,4}^2 + x_{2,2}^2 + x_{2,4}^2 \right)$

\[ = (2^2 + 0^2 + 4^2 + 2^2) = 24 \]

4. $x_{i j} = \left( x_{2,3} + x_{2,4} \right)^2 + \left( x_{3,3} + x_{3,4} \right)^2$

\[ = (4 + 2)^2 + (2 + 8)^2 = 136 \]

5. $x_{i j} = \left( x_{3,8} + x_{5,9} + x_{6,8} + x_{6,9} \right)^2$

\[ = (5 + 4 + 3 + 2)^2 = 196 \]
\[ x_{3j} = \left( x_{3,1} + x_{3,2} + \ldots + x_{3,10} \right) = (2 + 3 + \ldots + 2) = 33 \]

\[ x_{16} \sqrt{2} = (3^2 + 1^2 + 8^2 + \ldots + 1^2) = 143 \]

\[ \frac{2}{x_{12}} \sqrt{2} = 29^2 = 841 \]

\[ x_{ij} = 243 \]

\[ x_{12} x_{13} = (x_{1,2} x_{1,3}) + (x_{2,2} x_{2,3}) + \ldots + (x_{7,2} x_{7,3}) = (4 \cdot 2 + 8 \cdot 4 + \ldots + 1 \cdot 7) = 100 \]

\[ (x_{5j} - x_{4j}) = (x_{5,1} - x_{4,1}) + (x_{5,2} - x_{4,2}) + \ldots + (x_{5,10} - x_{4,10}) = x_{5j} - x_{4j} \sqrt{2} = (40 - 20) = 20 \]

\[ (x_{5j} - x_{4j})^2 = (0 - 1)^2 + (2 - 0)^2 + (6 - 3)^2 + \ldots + (4 - 8)^2 = 138 \]

\[ x_{5j}^2 - x_{4j}^2 = (0^2 + 2^2 + \ldots + 4^2) - (1^2 + 0^2 + \ldots + 8^2) = 122 \]

\[ \frac{2}{x_{5j}} \sqrt{2} - \frac{2}{x_{4j}} \sqrt{2} = (40^2 - 20^2) = 1,200 \]

\[ (x_{3j} - x_{4j})^2 = x_{3j} - x_{4j} \sqrt{2} = [40 - 20]^2 = 400 \]

\[ 3x_{2j} = 3(x_{2,1}) + 3(x_{2,2}) + \ldots + 3(x_{2,10}) = 3(x_{2,1} + x_{2,2} + \ldots + x_{2,10}) = 3 \frac{x_{2j} \sqrt{2}}{j} = 3(30) = 90 \]
\[(x_{4j} - 6) = (x_{4,1} - 6) + (x_{4,2} - 6) + \ldots + (x_{4,10} - 6) = (x_{4,1} + x_{4,2} + \ldots + x_{4,10}) - 6 - 6 - \ldots - 6\]

\[= \frac{x_{4j}}{10} - 10(6) = (20 - 60) = -40\]
Section 12—Abbreviations and glossary

Abbreviations

AV: Assessed Value
AVM: Automated Valuation Model
BOPTA: Board of Property Tax Appeals
CAFFAA: County Assessment Function Funding Assistance Account
CAAP: Computer Assisted Appraisal Program
COD: Coefficient of Dispersion
COV: Coefficient of Variation
CPR: Change Property Ratio
DOR: Department of Revenue
IAAO: International Association of Assessing Officers
MAV: Maximum Assessed Value
MLS: Multiple Listing Service
PRD: Price Related Differential
RMV: Real Market Value
RP: Real Property

Glossary

Absolute deviation: In an array, the absolute value of the difference between a sample point and the median. For assessment purposes, the median ratio is the central tendency used to calculate the Coefficient of Dispersion. Its formula is expressed as:

\[ AD = |X_i - \bar{X}_{median}| \]

Absolute value or number: The value of a number regardless of its sign. For example: 3 and -3 both have an absolute value of 3. An absolute number is expressed between two vertical lines:

\[ |5 - 15| = | -10| = 10 \]

Abstract of title: A summary of all conveyances, such as deeds or wills, and legal proceedings, giving the name of the parties, the description of the land, and the agreements, arranged to show the continuity of ownership for a specific piece of property. See also title.

Account number: A number assigned to each property by which it is listed and identified on the assessment roll and tax roll. ORS 308.215 requires that property be listed in sequence by account number. Any number that is permanently assigned to a property can serve this purpose. Other points of reference used are key numbers, reference numbers, etc. (Ref. 1989 Oregon Cadastral Map System, Volume 1, Concepts and Standards Manual.)

Adjustment area: A group of properties to which a given percentage adjustment is applied to real market value as a result of a ratio study. This group of properties is usually synonymous with a market area, maintenance area, study area, etc.

Adjustment, market value: The percentage or dollar amounts applied to real market value as a result of ratio studies.

Adjustment programs:

Blanket adjustment program: Adjustments, dollar or percentages, applied to all property in an equal amount, ignoring property location and/or property class. For example, a 10 percent adjustment applied to the prior year’s real market value of all classes of property in a valuation area, or areas, in the county is a blanket adjustment.

Selective adjustment program: Adjustments applied to properties on a selective basis that considers trends and indexes as they relate to each property class, or properties within a property class. For example, varying percentage or dollar adjustments applied by class of property by appraisal area is a selective adjustment program. The percentage relationship between the prior year’s real market value and an estimate of current real market value made by a qualified appraiser for a particular property.

Adjusted sales price: The sales price that results from adjustments made to the stated sales price to account for effect of time, personal property, financing, etc.

“After” ratio study: The “After” ratio study is a sales ratio study designed to test whether or not a county’s annual valuation program is producing real market values that meet the requirements of bringing all properties to 100 percent of real market value. See OAR 150-308.027(5)(D)(ii) and OAR 150-309.200(B)(12).

Appraisal date: For mass appraisal this is a predetermined point in time to which all appraisals are made. All sales used in the pre-appraisal setup are adjusted to this date to reflect either inflationary or deflationary trends in the market. This date usually differs from the assessment date or the inspection date.

Appraisal ratio: The percentage relationship (ratio) between a property’s current year roll real market value and its newly appraised real market value.

Appraisal ratio study: A statistical compilation of appraisal ratios for a representative group of properties.
in the county. These properties are randomly selected on a property class basis to produce an indication of the ratio of the current year real market value for a taxable property in a particular class of property within an appraisal area or market area. Generally used in areas of limited or no sales data.

**Arithmetic mean:** A measure of central tendency also called the average. The mean is the total of all the ratios in the array divided by the number of the ratios in the array. Repeat this procedure for each property class, by market area, which you have identified in your county.

\[
\bar{X} = \frac{\text{Total Ratios}}{\text{number of sales in array}}
\]

**Arm's-length transaction:** A transaction freely arrived at in an open market, unaffected by abnormal pressure or by the absence of normal competitive negotiations, as might be true in the case of a transaction between related parties.

**Assessment date:** January 1 at 1:00 a.m. See ORS 308.210.

**Assessment program:** The entire process used by the assessor to administer the property tax system.

**Assessment roll:** A certified document prepared annually by the assessor with a comprehensive listing of all taxable property within the county. See ORS 308.210 for contents of the assessment roll.

**Assessment year:** January 1 through December 31.

**Assessed Value (AV):** The lower of the property’s maximum assessed value (MAV) or real market value (RMV). For specially assessed property, the lesser of RMV or MAV for any market portion, plus the lesser of the specially assessed value (SAV) or maximum specially assessed value (MSAV) for each individual soil class, qualified home site, and on-site development.

**Average absolute deviation:** The average of the absolute deviation in the array.

\[
\text{AAD} = \frac{\sum |X_i - \bar{X}_{\text{median}}|}{n}
\]

**Average deviation:** A measure of dispersion computed by dividing the total of absolute deviations by the number of sales in the class.

**Bias:** See sample bias.

**Board of Property Tax Appeals (BOPTA):** Local appeal board that replaced the board of equalization and board of ratio review. The board convenes the first Monday in February of each year.

**Building class:** The quality classification (1-8) of the principal structure on the property sometimes referred to as the factor book class.

**Centrally assessed property (ORS 308.515):** Property assessed by the Department of Revenue. It includes property used by a company in performing any of the following businesses or services: rail transportation; private rail cars; air transportation; communications; electrical generation; transmission and distribution; natural gas distribution; gas and oil pipelines; and water transportation.

**Central tendency:** The tendency of most kinds of data to cluster around some type or central value, such as a median or mean.

**Certified assessment roll:** The real market values for the year just prior to the current roll in preparation. See assessment roll.

**Changed Property Ratio (CPR):** Ratio determined by dividing the average maximum assessed value (AMAV) by the average real market value (ARMV) for the same area and property class of unchanged property, countywide. The constitutional definition does not include the word “countywide” in the CPR definition. If you read the definition of “Area” in ORS 308.149, it states that area means the county in which the property is located. Hence, the policy is to calculate the CPR countywide.

**Coefficient of determination ($r^2$):** The proportion of the total variance in the dependent variable that is explained by the independent variables; the proportion of total variance explained by the regression.

**Coefficient of Dispersion (COD):** The COD facilitates comparison of the deviation or dispersion about different sized medians. It is the ratio of the average absolute deviation to the median. The average deviation is converted to a percentage. It is calculated with the following formula (since it is expressed as a percent, multiply by 100 as shown).

\[
\text{COD} = \frac{\text{AAD}}{\bar{X}_{\text{Median}}} \times 100
\]

**Coefficient of Variation (COV):** A relative measure of dispersion. The ratio of the standard deviation to the arithmetic mean. Since the standard deviation is expressed as a percent of the mean, the COV facilitates comparison of variability about different sized means. The standard deviation divided by the mean, times 100 (standard deviation is expressed as a percentage), is calculated with the following formula:

\[
\text{COV} = \frac{s}{\bar{X}_{\text{Mean}}} \times 100
\]

**Computer Assisted Appraisal Program (CAAP):** Means any use of a computer to calculate or develop real property values, or to store any property characteristics. The entire process used by the assessor to value property using computer-assisted valuations or computerized valuation methods.
Condition code(s): A numeric code reflecting the circumstances of each sale transaction. It is the result of the sale confirmation process. After each sale is verified and coded as to its usability in the ratio analysis process, all sales can then be sorted by the condition code desired by the analyst. The list showing the options in a coded fashion (for concise identification) is in Chapter 5.

Confidence interval: For a given confidence level, the range within which one can conclude that the population parameter (such as the median or mean appraisal ratio) lies. The reliability of the confidence interval depends on the extent to which any required statistical assumptions are met.

Confidence level: The required degree of confidence in a statistical test or confidence interval, commonly 90, 95, 99 percent. A 95 percent confidence interval would mean, for example, that one can be 95 percent confident that the population parameter (such as the median or mean ratio of appraised values to real market values) falls in the indicated range.

Consideration: The price or subject matter that induces a contract; may be in money, commodity exchange, or a transfer of personal effort. In appraisal, usually the actual price at which the property is transferred.

Contract: An agreement between competent legal parties to do some legal act or to refrain from doing some legal act in exchange for consideration. See land contract.

Conveyance: A written instrument that passes an interest in real property from one person to another; may be a deed, mortgage, or lease, but not a will.

County Assessment Function Funding Assistance Account (CAFFAA): A fund that is established by ORS Chapter 294 to give quarterly grants to counties that provide resources to achieve compliance, if the counties planned estimate of expenditures for assessment and taxation so determined are adequate.

Current Assessment Roll: The roll in preparation for the tax year that lists the properties identified as of January 1.

Data: In appraisal, it is the information pertinent to a specific assignment. In statistics, it is information or fact, most generally in numerical form, that can be classified by qualitative characteristics (ratios), size, frequency distribution, or time (time series or regression analysis).

Date of sale: Date conveyance instrument was signed and notarized, signifying the date that sale price or terms were agreed upon between the buyer and seller.

Deed: A legal instrument in writing that, when properly executed and delivered, conveys an estate or interest in real property. Examples, listed in their order of importance, are:

General warranty deed, a.k.a.: warranty deed, statutory warranty deed: This deed provides the greatest amount of protection of any other deed type to the grantee. Grantor warrants protection (covenants) against all valid claims to the property’s title since private ownership and into perpetuity.

Special warranty deed: This deed conveys the title to the described property with limited protection for the grantee. The protection, referred to as warranties or covenants, is limited to the acts created or suffered by the grantor.

Bargain and sale deed: This deed conveys the entire estate as [legally] described, held by the grantor. There are no warranties or covenants concerning the quality of title being conveyed by the grantor.

Quitclaim deed: This deed is used to convey title or relinquish the interest, if any, of the grantor. No quality of title is implied.

Trust deed: A deed by which a trustor (borrower) conveys his title to a trustee for the benefit of a beneficiary (lender) as security for money borrowed against the property.

“Statutory—deed”: Refers to ORS 93.580 et seq; cites in statute the implied covenants, minimal verbiage for certain deeds; cites the types of deeds with this reference; provided for by legislative action.

Deviation: The difference between the selected ratio (central tendency) and the individual ratios in an array. In this formula the median is used.

\[ D = X_i - \text{Median} \]

Dispersion: In statistics, the degree of scatter of a set of terms or observations, usually measured from a central tendency such as the mean or median.

Equity: The degree to which assessment bears a consistent relationship to real market value. Equity of assessment means property groups are valued at the same level of assessment, for example 100 percent of RMV. Equity is closely related to uniformity. See also horizontal inequity and vertical inequity.

Frequency distribution: A tabulation of individual ratios, usually expressed in a graph format, determined by counting the ratios falling within uniform ratio spreads, such as: 10, 20 or 30 percentage points.

Geometric mean: A measure of central tendency that is not as susceptible to distortion as the mean and weighted mean. This measure of central tendency is computed by multiplying all the ratios together in the array and dividing by their -nth root, where n is the number of sales in the array.

\[ \text{Geometric mean} = \left( X_1 \times X_2 \times \ldots \times X_n \right)^{1/n} \]

\[ X_{\text{Geo Mean}} = \sqrt[n]{X_1 \times X_2 \times \ldots \times X_n} \]
Grantee (buyer): A legal party to which property is transferred by deed or other instruments.

Grantor (seller): A legal party who transfers property by deed or grants property rights through any other instrument (seller).

Heterogeneous: Mixed, varied, non-homogeneous.

Highest and best use: The highest value that a property is capable of achieving at the time of appraisal considering the legally permitted use, financial feasibility, the capability to produce the greatest net return to the land and/or buildings over a given period, and what is physically possible.

Histogram: A bar chart or graph of a frequency distribution in which the lengths of the horizontal or vertical bars are proportional to the number of the percentages of observations in each defined set(s) of boundaries.

Hold-out-sample: A sample of sales that have been collected after the sales ratio year, whereby the ratio level is determined from this sample and a comparison is made of the current ratio level to the projected ratio level.

Homogeneous: Describes a market area where the property types and uses are similar, and the inhabitants have compatible cultural, social and economic interests.

Horizontal inequity: Differences based on criteria of improvement grades rather than value range in the levels of appraisal of groups of properties. For example, properties in one market area may have a higher appraisal level than similar properties in another market area. See vertical inequity.

Index: A number, usually expressed as a percentage, used to measure change such as a construction cost index. Indexes are developed to identify the amount of change to be made by applying adjustments. (See relative index for further explanation as to how it was used in previous ratio studies.)

Instrument: In relation to real estate, the term refers to a formal legal document, such as deed, contract, mortgage, lien, lease, will, etc. For assessor use, the instrument must have recordation number(s) from the County Clerk’s office in which the property is located.

Instrument number: Volume and page, microfiche, or other traceable filing number to locate the date and time of instrument recordation, as with deeds, mortgages, contracts, liens, etc.

Land contract: A real estate installment purchase agreement whereby the buyer may use, occupy, and enjoy land, but no deed is given by the seller (no title has been passed) until all or specified part of the sale price has been paid; subsequently evidenced by a valid recorded deed. (Also referred to as land sale contract, contract for sale, memorandum of contract.)

Locally appraised: Real and personal property appraised by county assessor’s staff.

Manufactured structure: A class of structures built off-site, designed to be moved “…on the public highways that have sleeping, cooking and plumbing facilities that are intended for human occupancy, and that are being used for residential purposes.” This class of structure includes manufactured dwellings, mobile homes, manufactured homes, recreational vehicles, and recreational structures and are further identified by year of manufacture and limitations of use described in ORS 446.003.

Market area: That geographic area or political jurisdiction within which alternative similar properties are effectively competitive with the subject property in the minds of probable potential purchasers. A group of properties that generally share important characteristics that influence value. Each market area should contain a sufficient number of accounts to ensure an adequate sales sample for analysis.

Market price: The amount actually paid, or to be paid, for a property in a particular transaction. Differs from market value in that it is an accomplished or historic fact, whereas market value is and remains an estimate until proved. Market price involves no assumption of prudent conduct by the parties, or absence of undue stimulus, or of any other condition basic to the fair or open market value concept.

Mass appraisal: A method of appraising a large number of properties at one time by adopting standard techniques, giving due consideration to the valuation process so that uniformity and equity of values can be achieved between all properties.

Maximum assessed value (MAV): A term defined by Measure 50, passed by Oregon voters in 1997. The maximum (limit) of a property’s assessed value (AV). For the 1997–98 tax year, maximum assessed value (MAV) was the 1995–96 real market value (RMV) less 10 percent. For tax years after 1997–98, the MAV will be the greater of 103 percent of the property’s assessed value from the prior year or 100 percent of the property’s MAV from the prior year. MAV may be increased or recalculated under certain circumstances to reflect changes to the property (exceptions).

Mean: The result of adding all the values of a variable and dividing by the number of values. (See also arithmetic mean or average.)

Median: A measure of central tendency calculated by determining the exact middle ratio in an array. The value of the middle item where an odd number of items are arrayed according to size; or the arithmetic average of the two central items, if there is an even number of items. It is a positional average and is not affected by the size
of extreme values. In an array, for an example, extreme ratios may skew the mean or the weighted mean. However, the median and the geometric mean will be less subject to the influence of the extreme ratios.

\[(n + 1) \div 2\]

\(n\) equals the number of sales in the array.

**Midpoint (selected ratio):** A ratio within the sales collection period that best represents the majority of sales activity (month or quarter). Not necessarily the middle of the sale year.

**Mode:** A ratio that occurs most frequently in a ratio array.

**Modular home/structure:** “Mobile modular unit” means a prefabricated structure that is more than eight and one half feet wide, is used for commercial or business purposes and is capable of being moved on the highway. Per ORS 308.866.

**Multiple listing service (MLS):** A commercial service that provides a system that pools the price listings of all member real estate companies, for a fee. It effectively expands the offerings a real estate agency may show to prospective buyers and extends the marketing of an agency’s own listings.

**Neighborhood:** See market area.

**Normal distribution:** A theoretical frequency distribution often approximated in real world situations. It is symmetrical and bell shaped; 68 percent of the observations occur within one standard deviation of the mean and 95 percent within two standard deviations of the mean.

**Outlier:** An observation that has an unusual value, that varies widely from a measure of central tendency. Some outliers occur naturally, others may be due to data error.

**Parameter:** Descriptive characteristics of a population as a whole. For instance, it could be the average square footage, or the average real market value, or the average percent good in the market place.

**Personal property:** Any property that is not realty; all moveable items not permanently affixed to or part of real estate. Also known as chattels. Intangible personal property (i.e., mortgages, computer software, etc.) is not assessable in Oregon. Beginning in 1997-98, most personal property accounts less than $10,000 in value, but excluding manufactured structures, are not required to pay property tax.

**Population:** All the properties in an appraisal area, market area, or study area.

**Price-related differential (PRD):** The price-related differential is a measurement of assessment regressivity and progressivity. It is calculated by dividing the mean by the weighted mean. Price-related differentials greater than 1.00 suggest that the high-valued parcels in the array are under-appraised (regressive), thus pulling the weighted mean below the mean. If the price-related differential is less than 1.00, it suggests that the high-valued parcels are relatively over-appraised (progressive), pulling the weighted mean above the mean.

\[PRD = \frac{\bar{X}_{\text{Mean}}}{X_{\text{Wt. Mean}}}\]

**Progressivity:** Appraisals are considered progressive where high-valued properties are over-appraised relative to low-valued properties.

**Property class:** A three-digit code number, maintained on a continuing basis, for each individual parcel of locally assessed real property in a county. The classification assigned will be determined by the land’s highest and best use except when specially assessed. OAR 150-308.215(1)-(A) lists the property class codes approved by the department.

**Ratio:** Relational value in number or degree between two similar things. The relative size of two quantities expressed as the quotient of one divided by the other. See sales ratio.

**Ratio study:** The assessor’s certified ratio study required by ORS 309.200-(A) and filed with the clerk of the Board of Property Tax Appeals (Oct. 15). The contents must comply with OAR 150-309.200(B) and the current assessor’s ratio study procedures manual. This study estimates the percentage relationship between (1) the total prior year’s real market value of taxable property on the prior assessment roll, and (2) the total current real market value of the same properties in each property class countywide; in each appraisal area; within each appraisal area within each market area; and/or by month and quarter by sale date.

**Real Market Value (RMV):** The amount in cash that could reasonably be expected to be paid by an informed buyer to an informed seller, each acting without compulsion in an arm’s-length transaction occurring as of the assessment date for the tax year. As established by ORS 308.205.

**Real market value ratio:** The percentage relationship between the prior year’s real market value of taxable property on the certified assessment roll and the same property on the current assessment roll.

**Real Property (RP):** An identified parcel or tract of land including any improvements. For purposes of the ratio study, all real property accounts in the county including those that the Department of Revenue is responsible for, i.e., utilities, unless otherwise indicated.

**Recalculation:** An automated valuation processing method where traditional mass-appraisal set-up techniques are utilized and applied. These techniques and market-based value components are implemented using tabled, computer-aided formats replicating real market value levels for applicable classes of real property.
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Recordation date: The calendar date and time of day that the written evidence of a completed transaction became of public record or notice in the county where the real property is located. This date and time are the critical elements which establish priority in the chain of title of a property.

Relative index: An index that calculates the percentage a property class contributes to the countywide ratio.

Reliability: In a statistical sense, concerns the degree of confidence one can place in a calculated statistic for a sample. There are two related measures of reliability: confidence intervals and standard error.

Regressivity: Appraisals are considered regressive where high-valued properties are under-appraised relative to low-valued properties.

Rural: Pertaining to the area outside the relatively larger and moderate-sized cities and surrounding population concentrations. Rural properties are generally characterized by farms, ranches, small towns, and unpopulated regions. Check with the planning and zoning department in your county for specific applications, limitations, and requirements. Also, check with utility companies and lending institutions for further considerations.

“Rurban:” Areas on the fringe of urban development that are, or may be in the process of being developed for urban uses. See caveats for rural.

Sale: The act of selling; exchange of goods or services for an amount of money or its equivalent (Webster’s Dictionary). For ratio purposes, see also arm’s-length transaction.

Sales analysis: Sales data used to analyze RMV levels by measuring changes in sales prices against prior year’s RMVs.

Sales array: A grouping of sales listed in ascending order according to the size of the ratio.

Sales list: A listing of all sales used in the ratio study prepared in accordance with OAR 150-309.200(c).

Sale price: The price at which the property actually sold. (See also market price.)

Sales Ratio: The percentage relationship between RMV from the certified assessment roll and the selling price for a particular property. This can be expressed as a percent or decimal. The common practice is to express the ratio as a whole number. Multiply the quotient by 100. This ratio is also an indication of RMV level.

Sales ratio = (RMV ÷ Sales Price) × 100 = Ratio

Sales ratio study: A statistical compilation of sales ratios designed to produce an indication of the real market value ratio of each property class countywide and each property class within each appraisal area, property class within each market area, and property class within each study area.

Scatter diagram: A graphic means of depicting the relationship or correlation between two variables by plotting one variable on the horizontal axis and one variable on the vertical axis. Often in ratio studies, it is informative to determine how ratios are related to other variables. A variable of interest is plotted on the horizontal axis and the ratios on the vertical axis.

Similarity, percent of (PS): A measurement of sample bias developed by the Oregon Department of Revenue. Percent of Similarity compares some known parameters of the population with its estimate from the sample. The measurement is simply the smaller (from the sample or population) number divided by the larger (from the sample or the population) number and expressed as a percent.

Sales take-off: The systematic process of taking pertinent information from recorded and unrecorded property transfers (deeds) on a month-by-month basis and organizing this information in a database or manual sales record file for future use.

Sample: A set of observations selected from a population. If the sample was randomly selected, basic concepts of probability may be applied.

Sample bias: Bias is a systematic distortion of the results from consistent error. It may be due to some flaw in measurement (poor statistical technique or application of condition codes), the method of selecting the sample (the consistencies and intentional distortion in the real estate marketplace), or the poor selection of market area parameters.

Situs address: The physical U.S. Mail address/location of the property (street address, rural route, etc.) although, typically assigned by the local planning division.

Standard deviation: A measure used to check the variation of the sample from the mean. The statistic calculated from a set of numbers by subtracting the mean from each value and squaring the remainders, adding together these squares, dividing by the size of the sample less one, and taking the square root of the result.

State responsibility industrial accounts (ORS 306.126, OAR 150-306.126): 

Principal industrial property: Any unit of industrial property having a RMV of the improvement on the assessment roll for the preceding year of over $5 million. Some examples: sawmills, food processing facilities, printing and publishing operations, etc.
**Secondary industrial property:** Any unit of industrial property having a RMV of the improvement on the assessment roll for the preceding year of more than $1 million but of $5 million or less. Some examples of state responsibility accounts: sawmills, plywood plants, paper mills, electronics, chemical manufacture, food processing, metals, etc.

**Statistical class (stat class):** A three-digit classification code (not to be confused with property classification) of structural improvements. This code identifies characteristics of that structure such as: type, stories, building class, etc.

**Straddle study:** Any study sensitive to change from a specific point, where the sample is developed from sales spanning equal distance from each side of the specific point (assessment date).

**Stratification:** A process of dividing data into smaller components, such as: identifying individual components of sales data and separating them from a larger assortment of sales data for analysis purposes. Examples could include analyses by square foot, by age, or year built. Another example could be stratifying an array of ratios into ranges—to 25 percent, 25 to 50 percent, 50 to 75 percent, etc.

**Study area:** Usually a smaller delineation than a market area. Typically, it is a group of properties identified during the sales ratio process when an analysis of the sales indicates a separate market is developing due to unique characteristics setting these properties apart from the rest of the area. A study area may develop into a market area or valuation area.

**Suburb, suburban:** A town or unincorporated developed area in close proximity to a city. Suburbs, largely residential, are often dependent on the city for employment and support services; generally characterized by low-density development relative to the city.

**Tax year:** The period for which the property is taxed (July 1–June 30).

**Title:** The union of all elements that constitute proof of ownership. It is the evidence that the owner is in legal possession of the property.

**Trend:** A series of related changes, such as real estate price trends, time trends, market trends, etc.

**Usable sale:** A sale used in a ratio study that meets the criteria for an arm’s-length transaction.

**Urban property:** Real estate located in an urban area, generally characterized by relatively high-density development and extensive availability of city water and sewer service. See also rural, “rurban,” and suburban.

**Valuation:** A universal term used to encompass all methods of valuing property, from the traditional physical reappraisal to alternative methods (i.e., recalculation, etc.).

**Valuation area:** An area in a county generally composed of one or more school districts, a city or political subdivision, or any other logical division established by the county assessor for the purpose of conducting an orderly valuation of taxable properties as required by ORS 308.234. All real properties in such an area normally will be valued at the same time.

**Valuation date:** The roll year for which the last valuation was made of the property.

**Variable:** Mathematically, in an equation, a component or value subject to change; statistically a phenomenon or characteristic associated with a population or sample.

**Vendee:** A buyer, typically associated with contract of sale.

**Vendor:** A seller, typically associated with contract of sale.

**Vertical inequity:** Differences in the levels of appraisal of properties related to the value ranges of the properties. That is, properties of higher value levels have appraisal levels different from properties of lower value. See horizontal Inequity. See IAAO texts. Often referred to when discussing price-related differential (PRD) with the PRD falling within the range of .98 and 1.03.

**Weight:** The percentage value that represents the relative importance of each element’s contribution to the total.

**Weighted mean:** A measure of central tendency determined by dividing the sum of the RMVs in an array by the sum of the sale prices (or other indications of market value) for each property class in each market area or countywide.

\[
X_{Wt.\ Mean} = \frac{\text{Total RMVs}}{\text{Total Sale Prices}} \times 100
\]
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## Appendix A

### Data analysts by county

**Baker**
- Trudy Lowery, 541-523-8203
tlowery@bakercounty.org
- 1995 Third St Ste 130
- Baker City OR 97814-3313

**Benton**
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caleb.nelson@co.benton.or.us
- 205 NW 5th St
- Corvallis OR 97330-4808

**Clackamas**
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  brandipet@clackamas.or.us
- Lynn Longfellow, 503-655-8671 ext 7609
  lynnlon@co.clackamas.or.us
- 168 Warner Milne Road
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**Clatsop**
- Nora Corkill, 503-338-3634
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- Courthouse 820 Exchange St Ste 200
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**Columbia**
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**Coos**
- Cindy Wideman, 541-396-3121 ext 231
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dave.messenger@co.gilliam.or.us
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  lane@oregontrail.net
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  Canyon City OR 97820-0185

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  Burns OR 87720-1599

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  Hood River OR 97031-2093
Appendix A (Continued)

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Lane
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Malheur
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Marion
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Van Khieu, 503-584-4706
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PO Box 14500
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Dallas OR 97338-3180
Appendices

Appendix A (Continued)

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Tillamook OR 97141-2394

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leeb@co.umatilla.or.us
Courthouse PO Box 68
Pendleton OR 97801-0068

Union
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jkelley@union-county.org
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La Grande OR 97850

Wallowa
Gay Fregulia, Assr, 541-426-4543 ext 38
wcassess@co.wallowa.or.us
Courthouse Rm 104 101 S River St
Enterprise OR 97828-5901

Wasco
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timl@co.wasco.or.us
Courthouse 511 Washington St
The Dalles OR 97058-2237

Washington
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Hillsboro OR 97124-3087

Wheeler
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donald.r.cossitt@co.wheeler.or.us
County Courthouse 701 Adams St Rm 103 PO
Box 326 Fossil OR 97830-0326

Yamhill
Nikki Orlaineta, 503-434-7521 ext 3675
orlainetan@co.yamhill.or.us
County Courthouse Assessor’s Office
535 NE 5th St Rm 135
McMinnville OR 97128-4592
Appendix B
Property Tax Division organizational structure

Property Tax Division
September 2009

Administrator
Jim Bucholz
PEMG 6403
pca 41200 Z7012 X38

Policy Liaison
John Phillips
OPA4 4332
pca 41200 X0873 M32

Executive Assistant
Mary Kintner
ESS1 4237
pca 41200 X0118 M17

Central Support
Brinlee K SOW
0004187A
pca 41200

Valuation
Vera Carriger
PEME 5194
pca 46400 X7008 X33

Cadastral Information Systems
Deferral, ORMAP, Timber
Rick Schack
PEME 4121
pca 47100 X7008 X33

Assessment and Taxation Standards
Mark Kinslow
PEME 4120
pca 43100 X7008 X33

September 2009
Appendix B (Continued)

Cost Analysis
- Reed AA3 4207 pca 46400

Valuation
Vera Carriger (2)
PEME 5194 pca 46400 X7008 X33

Project Coordination
-Tarr OPA2 4286 pca 46400

Appraiser Teams
Taraleen Elliott
PEMD 4202 pca 46300 X7006 X31

Appraiser Teams
Sean Barnhart
PEMD 4127 pca 46300 X7006 X31

Appraiser Teams
Merri Seaton
PEMD 4340 pca 46200 X7006 X31

Wood and Paper Team
- Buchanan AA4 4218
- Palmer AA3 5147
- Yecrk AA3 4338
- Barnett AA3 4196
- Junot AA3 4136
- Nelson AA3 4130
- Hunt AA2 4214*

Electronics Team pca 46300
- Vacant (1) AA4 4138
- Coppedge AA3 4199
- Rodriguez K AA3 4205
- Cochran AA3 4284
- Robinson AA3 4198
- Crawford AA2 4126

Comprehensive Team
-Johnson AA4 4128
-Shepherd AA3 4211
-Scott AA3 4211
-Motley AA3 4337
-Tucker AA3 4091
-Vacant AA3 4206
-Hubert AA2 4051
-Folsom AA2 4040

Support Team pca 46300
-Hansberry AS2 4029
-Grigoroff AS1 4147
-Smith OS2 4228
-Cannoy OS1 4229
-Vacant OS1 4231
-Ayala SOW 0004186

Training and Analysis
-Daniell AA4 4200
-Deupy AA4 4197 pca 46400

Electronics Team pca 46300
-Brutke AA4 4262
-Abuelkhair AA3 4212
-Saladino AA3 4201
-Taylor AA2 4246
-Thoesen AA2 4214*
-Mills AA2 4098

Utility Team pca 46200
- Olson AA4 4129
-Rodriguez G AA4 4204
-Hillstrom AA3 4245
-Kemer AA3 4137
-Dudley AA3 4137
-McEvoy AA3 4267
-Speare AA3 4135
-Hamilton AA2 4223

(1) Coppedge: WOC 03/18/09 to 03/18/10
(2) Schack: TWA 08/01/09 to 08/01/10

*Double-fill positions

Class   Class Number Salary Range
Title    Number
AA4  C0728 31
OPA2  C0871 27
AA3  C0727 28
AA2  C0726 25
AS2  C0108 19
AS1  C0107 17
OS2  C0104 15
OS1  C0103 12
SOW  C0100 7
Appendix B (Continued)

Assessment and Taxation Standards
Mark Kinslow
PEME 4120
pca 43100 X7008 X33

Field Appraisal Services - Bend
Tom Clemens
PEMD 4113
pca 43350 X7006 X31

Bend Field
- Turney AA4 4240
- Wagner AA3 4270
- O’Banion AA3 4108

Pendleton Field
- Kirby AA4 4075
- Lassen AA3 4242
- Payne AA3 4086

Eugene Field
- Gaines AA4 4281
- DeAvilla AA3 4244
- Cook AA3 4269

Field Appraisal Services - Salem
Mike Vaughn
PEMD 4329
pca 43600 X7006 X31

Salem Field
- King J AA4 4243
- Bowman AA3 4221
- Rhoades AA3 4085
- Anderson AA3 4133

Special Programs
- Thummel AA4 4139
- Sture AA3 4209
- Plass AA3 4261
- Vacant AA3 4049
- Culbertson AA3 4110
- Johnston PA2 4287
- Gates PA2 4287
- Pedersen PA2 4250
- Massie AS1 4191

Program Administration and Analysis
Linda Blacklock
PEMD 4103
pca 43400 X7006 X31

Program Services
- Tindall AA4 4241
- Stevens OPA3 4210
- Match AA3 4334
- Love PA1 4032
- Vacant OS2 4190

Farm Special Assessment
- Wright AA3 4131

Finance and Taxation
- King S PA2 4325
- Peterson PA2 4235
- Tiemeyer PA2 4252
- Kramer PA2 4189

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September 2009
Appendix B (Continued)

Cadastral Information Systems
Deferral, ORMAP, Timber

Rick Schack (3)
PME 4121
pca 47100 X7008 X33

Timber Tax and Deferral
Bram Ekstrand
PEMD 4115
pca 48300 X7006 X31

Timber
- Carter TA/A3 4093
- Toman TA/A3 4073
- Castor TA/A3 4095
- Frison TA/A3 4079
- Overhulser TA/A3 4082
- Weight OPA2 4088
- Wilson AS1 4145
- Grimes OS1 4001

Deferral Programs pca 47300
- Saalfield AS2 4013
- Van Santen OS2 4192
- Moore OS2 4182

Cadastral Information Systems
Brett Juul
PEMD 4117
pca 45100 X7006 X31

Unit Support
- Prychun IS6 4239
- Hood (2) OS2 4342
- Perez E SOW 0004552

Map Districs
- Therriault GPA 4167
- Vacant GPA 4160
- Mercer GPA 4166
- Kivley GPA 4169

Map Maintenance
- Bruch GSA 4165
- Allen GSA 4159
- Jenkins GAA 4154

Digital Remapping
- Ayers GSA 4161
- Vacant GSA 4158
- Ellsworth GSA 4160
- Keen GSA 4164
- Callahan GAA 4153
- Taylor GAA 4151
- Bucher GAA 4152
- Vacant GAA 4155
- Vacant (1) GS 4170

ORMAP pca 47700
- McClellan OPA3 4341

(1) Hood: TWA 04/16/07 to 09/30/09
(2) Hernandez: TWA 08/01/08 to 09/30/09
(3) Blacklock: WOC 08/17/09 to 08/17/10

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September 2009
## Property Tax Division Contacts

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<td>Allen, Michael G</td>
<td>PTD/CIS</td>
<td>503-945-8274</td>
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<td>Anderson, Karen E</td>
<td>PTD/ATS</td>
<td>503-945-8355</td>
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<td>Ayers, Robert A</td>
<td>PTD/Cadastral info systems</td>
<td>503-945-8883</td>
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<td>Barnett, Kathryn L</td>
<td>PTD/Valuation</td>
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<td>Blacklock, Linda D</td>
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<td>Bowman, Keith T</td>
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<td>Bruch, Elise A</td>
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<td>Castor, Richard L</td>
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<td>503-945-8311</td>
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<td>Clemens, Thomas C</td>
<td>PTD/Bend</td>
<td>541-388-6125</td>
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<td>Cochran, Cindy L</td>
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Appendix C

2009 calendar of assessment and taxation procedures

The time for filing or paying is extended to the next business day when the date for filing any correspondence, claim, or remittance falls on a Saturday, Sunday, or legal holiday (ORS 305.820). When the last date for a filing falls on a day when the particular office closes before the normal business day ends, the time is extended to the next day the office is open for business (ORS 174.125).

Note: These date extension provisions under ORS 305.820 and ORS 174.125 only apply when the public submits any writing or remittance required by law to the Department of Revenue, County Board of Property Tax Appeals, County Assessor, Tax Collector, or other taxing officials. The Department of Revenue, County Board of Property Tax Appeals, County Assessor, Tax Collector, or other tax officials must complete their obligations on or before the required date in the event of a holiday or weekend.

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<td>January</td>
<td>Assessment year begins</td>
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<td>Assessment date:</td>
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<td>Real property &amp; manufactured structures assessed as personal property</td>
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<td>Personal property</td>
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<td></td>
<td>Centrally assessed property (railroad cars &amp; utilities)</td>
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<td>State and federal agencies provide assessors with list of public lands sold</td>
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<td>Assessor determines qualification to farm use assessment</td>
<td>308A.062, 308A.068</td>
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<td>Assessor begins collection of sales data for ensuing years’ ratio study</td>
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<td>Tax Collector makes quarterly statement of collections</td>
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<td>County Treasurer distributes taxes (quarterly)</td>
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<td>Last day for nonprofit elderly homes to notify assessor that war veterans have been given property tax credit or face denial of exemption for next assessment year</td>
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<td>Due date for 2008 returns and to pay tax</td>
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<td>Forest Products Harvest Tax (FPHT)</td>
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<td>Small Tract Forestland Severance Tax (STF)</td>
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<td>February</td>
<td>DOR mails CAFFA grant applications to assessors this month</td>
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<td>Stipulations for value reduction must be filed prior to convening of BOPTA</td>
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<td>Last day for designated centrally assessed property taxpayers to file their annual statements with the Department of Revenue</td>
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<td>Board of Property Tax Appeals (BOPTA) convenes on or after first Monday</td>
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<td>DOR distributes FPHT receipts</td>
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<td>Due date for second property tax installment</td>
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<td>Due date for oil and gas production tax for preceding calendar quarter</td>
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<td>Interest starts on second unpaid property tax installment</td>
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<td>Tax collector sends second notice of delinquent personal property taxes</td>
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<td>Unpaid oil and gas production tax becomes delinquent</td>
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<td>Last day taxpayer can apply for an extension until April 15 to file real, personal, and combined property tax returns.</td>
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<td>Last day for assessor to send income questionnaire to owners of non-exclusive farm use (non-EFU) farmland. (OAR 150-308A.071)</td>
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<td>Last day for coops to file their annual statements with DOR. (308.810)</td>
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<td>Filing deadline for food and egg processors exemption. (307.455)</td>
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<td>March</td>
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<td>Last day to timely file combined principal and secondary industrial and personal property returns with DOR. (308.290)</td>
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<td>Owner's last day to file real and personal property returns with county assessor. (308.290)</td>
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<td>Last day to file a personal property return and avoid 5% penalty (without extension). (308.296)</td>
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<td>Designated centrally assessed property taxpayers to file annual statements with DOR. (308.520)</td>
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<tr>
<td>March</td>
<td>15</td>
<td>Due date for payment of oil and gas production tax with extension. (324.110)</td>
</tr>
<tr>
<td>March</td>
<td>15</td>
<td>Last day telephone companies may file for exemption (in the first year it is requested). (OAR 150-307.240-(B))</td>
</tr>
<tr>
<td>March</td>
<td>16</td>
<td>Tax collector issues warrants to enforce payments of delinquent property taxes remaining unpaid February 15. (311.610)</td>
</tr>
<tr>
<td>March</td>
<td>31</td>
<td>Last day for taxing district to file boundary description and map with DOR. (308.225)</td>
</tr>
</tbody>
</table>

### April

- DOR distributes small private railroad car tax collected to counties.

1. Last day to file for exemption as a:
   - Veteran or surviving spouse of veteran. (307.260)
   - Private nonprofit corporation providing housing and care for elderly. (307.242)
   - Corporation providing nonprofit student housing. (307.460)
   - Nonprofit childcare facility in conjunction with nonprofit farm labor camp. (307.495)
   - Nonprofit corporation providing low income housing. (307.545)
   - Rural health care facility. (307.804)
   - Long term care facility. (307.811)
   - Ethanol production facility. (307.701)
   - Qualified business in Oregon enterprise zone. (285C.220)
   - Water Association. (307.210)

1. Last day for lessee or sublessee to file for exemption of taxable property held under lease, sublease or lease purchase agreement by institution, organization or public body other than state. (307.112)

1. Last day for lessee or sublessee to file for exemption on property leased from another exempt entity. (307.166)

1. Last day for owner to file for exemption of property held for art museums; public libraries; senior services centers; literary, benevolent, charitable and scientific institutions; fraternal or religious organizations; volunteer fire departments; certain child care facilities, schools and student housing;
Appendix C (Continued)

April (Continued)

burial grounds; cemeteries; property of crematory associations; wastewater and sewage treatment facilities; industry apprenticeship, or training trust property; public parks or recreation; and public beach access .......................... 307.162

1 Last day to file for cancellation of assessment on commercial facilities under construction ......................................................... 307.340

1 Last day to file pollution control facility exemption statement with assessor ............... 307.420

1 Last day to file for special assessment following acquisition of land through government exchange occurring on or after July 1 of prior year ....................... 308A.730

1 Last day to apply for special assessment of:
   Non-EFU land ........................................................................ 308A.077, 308A.080
   Wildlife habitat land ................................................................. 308A.424
   Conservation easement ............................................................ 308A.456
   Western Oregon designated forestland ........................................ 321.358
   Eastern Oregon designated forestland ........................................ 321.815
   Small tract forestland (STF) option ............................................ 321.706

1 Last day for county governing body to notify assessor and applicant of approval or denial of application for open space land assessment .......................... 308A.312

1 Last day for city to file with county assessor ordinances approving or disapproving application for single-unit housing in distressed urban areas............. 307.674

1 Last day for county governing body to file with county assessor ordinances approving or disapproving application for low income rental housing exemption .................................................. 307.527

1 DOR distributes proposed specially assessed values of forestland .......................... 321.210

1 Last day for assessor to compute in lieu tax per requests received by 12/31/07 ........ 307.120

7 Tax Collector makes quarterly statement of collections .................................... 311.395

10 Assessor sends written notice of late filing to war veteran (certified disabled by a physician) ......................................................... 307.260

14 Last day for assessor to disapprove the re-qualification of previously disqualified non-EFU farmland ......................................................... 308A.089

14 County Treasurer distributes taxes (quarterly) ..................................................... 311.395

15 Last day for owner of land assessed as non-EFU farmland to:
   file for farm use assessment of wasteland .................................... 308A.074
   file for farm use assessment of land under farm dwellings. ....................... 308A.253
   return income questionnaire to assessor ........................................ 308A.253
   OAR 150-308A.071

15 Last day to file real, personal, and combined property tax returns with an extension to avoid a late filing penalty ........................................ 308.290, 308.295, 308.296

15 Last day for senior or disabled citizen to file for deferral of taxes on homestead .......... 311.668

15 BOPTA adjourns ........................................................................ 309.026

30 Quarterly estimated tax for 2009 FPHT due ...................................................... 321.045
<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>May</td>
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</tbody>
</table>
### Appendix C (Continued)

| June (Continued) | 30 | Last day to appeal 2005-06 value to DOR under supervisory authority | 306.115 |
| | 30 | Last day for BOPTA to issue amended orders | 309.110 |
| | 30 | Last day for appeal of forestland special assessment value | 321.219 |
| | 30 | Last day for county assessor to mail disqualification notice for farmland, designated forestland, small tract forestland, wildlife habitat land, conservation easement land (general rule) | 308A.724(1)(b) |
| | 30 | Tax and fiscal year-end | 308.007 |

| July | 1 | Tax and fiscal year begins | 308.007 |
| | 1 | Enterprise zone report due from assessor to DOR and OECDD | 285C.130 |
| | 1 | Lien date for: real and personal property taxes | 311.405 |
| | | centrally assessed property taxes | 311.655 |
| | 1 | Last day for assessor to file certified ratio study with DOR | OAR 150-309.200-(C) |
| | 1 | Assessment date for damaged or destroyed property if application filed by August 1 | 308.146 |
| | 2 | Unpaid gross earnings tax in lieu of property tax on distribution and transmission of electric cooperatives becomes delinquent | 308.807 |
| | 8 | Tax Collector makes quarterly statement of collections | 311.395 |
| | 15 | Treasurer distributes in lieu tax payments to school districts | 307.120 |
| | 15 | County Treasurer distributes taxes (quarterly) | 311.395 |
| | 15 | Assessors act on recommendations/orders of director regarding real market value standards or send written objection to DOR | 309.203 |
| | 15 | Taxing districts file notice of tax levies with county assessor | 310.060 |
| | 16 | Tax collector prepares foreclosure list | 312.030 |
| | 31 | Quarterly estimated tax for 2009 FPHT due | 321.045(4) |

| August | 1 | Director completes review and apportionment of centrally assessed property assessment roll | 308.600 |
| | 1 | DOR provides assessors a list of all industrial property accounts located in their counties for which the state had appraisal responsibility in the preceding year | OAR 150-306.126(1) |
| | 1 | Last day for counties to file a certified ratio study when extension granted by DOR | 309.200, OAR 150-309.200-(C) |
| | 1 | Tax collectors report prior fiscal year’s collections, delinquencies, etc. to county clerk, county court and DOR | 311.531 |
| | 3 | Last day for active duty service member or lawful occupant to file for exemption | 307.289 |
| | 3 | Last day centrally assessed companies may request waiver of late filing penalty | 308.030 |
Appendices

**Appendix C (Continued)**

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
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</thead>
<tbody>
<tr>
<td>August 3</td>
<td>Last day to file a personal property return and avoid a 50% penalty on the tax ..........308.296</td>
</tr>
<tr>
<td>(Continued)</td>
<td>August 1(3rd this year because the 1st is a Saturday) or 60 days after the destruction (whichever is later) is the last day to file application with assessor to have real market value and assessed value of destroyed or damaged property determined as of July 1 ........................................308.146</td>
</tr>
<tr>
<td>3</td>
<td>Last day for owners of EFU or non-EFU farmland, designated forestland, small tract forestland, wildlife habitat or conservation easement special assessment disqualification to file for another special assessment if disqualification occurs prior to July 1 ......................... 308A.724</td>
</tr>
<tr>
<td>3</td>
<td>Last day for owner to file for special assessment following acquisition of land through government exchange occurring prior to July 1 .................. 308A.730</td>
</tr>
<tr>
<td>3</td>
<td>Last day to file claim for active duty military service members exemption with assessor for previous tax year ..........................................................307.289</td>
</tr>
<tr>
<td>3</td>
<td>Last day for owner to file proof for cancellation of crab pot assessment .......................508.270</td>
</tr>
<tr>
<td>10</td>
<td>DOR distributes FPHT receipts ................................................................................321.152</td>
</tr>
<tr>
<td>14</td>
<td>Last day for county assessor to mail disqualification notice for: The reason that land is no longer forestland .....................................321.366, 321.845</td>
</tr>
<tr>
<td></td>
<td>Land is no longer in farm use .............................................................................308A.113, 308A.116</td>
</tr>
<tr>
<td>14</td>
<td>Last day owner may request to pay deferred additional taxes for collection in the current general property tax roll ..................................................308A.715</td>
</tr>
<tr>
<td>14</td>
<td>Due date for oil and gas production tax for preceding calendar quarter ..................324.110</td>
</tr>
<tr>
<td>15</td>
<td>Tax collector publishes foreclosure list and submits to district attorney for application for judgment and decree ........................................................312.050</td>
</tr>
<tr>
<td>15</td>
<td>Last day for assessor to notify applicant in writing why application for: Forestland designation was denied ......................................................321.358, 321.815</td>
</tr>
<tr>
<td></td>
<td>Small tract forestland was denied ........................................................................321.706</td>
</tr>
<tr>
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<td>Wildlife habitat was denied ..................................................................................308A.424</td>
</tr>
<tr>
<td>15</td>
<td>DOR distributes county portion of STF Severance Tax ...........................................321.751, 321.754</td>
</tr>
<tr>
<td>15</td>
<td>DOR mails the final centrally assessed tax roll to the companies and the counties (August 15-19) ............................................................ xxxxxx</td>
</tr>
<tr>
<td>15</td>
<td>Director files oath with the Secretary of State’s office regarding completeness of the utility roll (August 15-19) ..................................................308.610</td>
</tr>
<tr>
<td>15</td>
<td>Tax collector publishes foreclosure list and submits to district attorney for application for judgment and decree ........................................312.050</td>
</tr>
<tr>
<td>16</td>
<td>Tax collector mails copy of newspaper foreclosure notice to each incorporated city in the county following publication of list ................................312.040</td>
</tr>
<tr>
<td>16</td>
<td>Last day to mail notice of the foreclosure proceeding by certified and regular first class mail to each owners included in the foreclosure list ................312.040</td>
</tr>
<tr>
<td>16</td>
<td>Publish notice of foreclosure proceeding in newspaper ........................................312.040</td>
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<tr>
<td>16</td>
<td>Unpaid oil and gas production tax becomes delinquent ...........................................324.110</td>
</tr>
<tr>
<td>Month</td>
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</table>

1 This date should be a range from September 30 to October 2 since the law actually says five business days after September 25.
## Appendix C (Continued)

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
<th>Code/Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>November</td>
<td>Last day for submittal of Appraisal/Valuation Plan</td>
<td>OAR 150-309.200</td>
</tr>
<tr>
<td></td>
<td>(First Tuesday after the First Monday) Taxing district election date</td>
<td>203.085</td>
</tr>
<tr>
<td>4</td>
<td>DOR distributes FPHT receipts</td>
<td>321.152</td>
</tr>
<tr>
<td>10</td>
<td>Due date for first property tax installment</td>
<td>311.505</td>
</tr>
<tr>
<td>15</td>
<td>Due date for oil and gas production tax for preceding quarter</td>
<td>324.110</td>
</tr>
<tr>
<td>15</td>
<td>DOR provides final list of primary and secondary industrial accounts that should be DOR responsibility to the assessor</td>
<td>OAR 150-306.126(1)</td>
</tr>
<tr>
<td>15</td>
<td>Last day for certain farm labor and childcare facilities to make in lieu tax payment to county treasurer</td>
<td>307.490</td>
</tr>
<tr>
<td>16</td>
<td>Last day that a centrally assessed company may appeal to the Tax Court a decision of the director</td>
<td>305.280</td>
</tr>
<tr>
<td>16</td>
<td>Unpaid oil and gas production tax becomes delinquent</td>
<td>324.110</td>
</tr>
<tr>
<td>16</td>
<td>Interest starts on unpaid first property tax installment</td>
<td>311.505</td>
</tr>
<tr>
<td>16</td>
<td>Tax collector sends notice of delinquent personal property taxes</td>
<td>311.547</td>
</tr>
<tr>
<td>20</td>
<td>Last day taxpayer may make estimated payment during 15-day period if taxes cannot be determined from tax roll by November 5</td>
<td>311.250</td>
</tr>
<tr>
<td>30</td>
<td>Last day to mail notice of increase of current year values</td>
<td>311.208</td>
</tr>
<tr>
<td>December</td>
<td>DOR/Assessor mails blank property tax returns this month</td>
<td>308.290</td>
</tr>
<tr>
<td>1</td>
<td>Last day for owners of low income rental housing to file for exemption</td>
<td>307.523</td>
</tr>
<tr>
<td>1</td>
<td>Tax collector may begin quarterly statements of collection if finished with current year processing</td>
<td>311.395</td>
</tr>
<tr>
<td>15</td>
<td>Last day for DOR to send notice to taxpayers who have claimed deferral of property taxes summarizing current year taxes and giving information about paying deferred taxes</td>
<td>311.678</td>
</tr>
<tr>
<td>15</td>
<td>Last day to file application for designation as forest land</td>
<td>321.358, 321.815</td>
</tr>
<tr>
<td>15</td>
<td>Last day owner may requalify for land disqualified for the reason the land was no longer in farm use</td>
<td>308A.089</td>
</tr>
<tr>
<td>15</td>
<td>Last day to appeal to DOR under hardship statute</td>
<td>307.475</td>
</tr>
<tr>
<td>15</td>
<td>Tax collector serves warrants to enforce payments of delinquent personal property taxes remaining unpaid November 15</td>
<td>311.610</td>
</tr>
<tr>
<td>15</td>
<td>Last day to pay additional taxes without interest on additional current year value of property</td>
<td>311.208</td>
</tr>
<tr>
<td>15</td>
<td>Due date for oil and gas production tax with extension</td>
<td>324.110</td>
</tr>
<tr>
<td>16</td>
<td>Additional taxes and interest on additional current year value become delinquent</td>
<td>311.208</td>
</tr>
</tbody>
</table>
December 31 Last day to file for exemption with a late filing penalty (applies only to tax years for which exemptions are first claimed) …… 307.112, 307.162, 307.166
31 Persons having a lease or other possessory interest in exempt port property file request for assessor to compute the payment of in lieu of tax ……….…… 307.120
31 Owner’s last day to apply for open space land assessment preceding first tax year …………………………………………………………………………. 308A.306
31 Owner’s last day to file for riparian land exemption ……………………………………… 308A.356
31 Last day to file petition with BOPTA ………………………………………………… 305.820, 309.100
31 Assessor completes collection of sales data for sales ratio study ………………… 309.200
31 Last day to apply to assessor for correction of maximum assessed value based on error in square footage ………………………………………. 311.234
31 Last day for owner of historic property to make application with state Historic Preservation Officer for the classification and special assessment for the 2009-10 tax year ……………………………………… 358.487(1)
31 Last day for assessors and registered appraisers to file proof of completion of continuing education ………………………………………………………. 308.057