City of Philadelphia

Office of Property Assessment

Mass Appraisal Valuation Methodology Overview

Tax Year 2025

Released September 2024

Contents

Introduction

What Did OPA Do?

For Tax Year 2025, the Office of Property Assessment (OPA) again determined the value of properties through mass appraisal valuation. The term tax year refers to the calendar year in which taxes are due. The new values of more than 580,000 residential, commercial, industrial, and institutional properties in the City take effect for Tax Year 2025. The effective date of the new assessment is January 1, 2025, with property taxes due on March 31, 2025.

What Process Does OPA Use?

OPA uses mass appraisal valuation to value every property in Philadelphia. Mass appraisal is the process of determining property values as of a given date by looking at sales information, property characteristics, and statistical methods. Mass appraisal is a widely accepted tool for the valuation of property for the purposes of taxation.

Why Does OPA Do Revaluations?

The goal of any valuation approach is to ensure that property assessments reflect current market conditions through the period being valued, and OPA aims to achieve the most accurate, uniform, and equitable assessments possible.

Did This Revaluation Make Assessments Better?

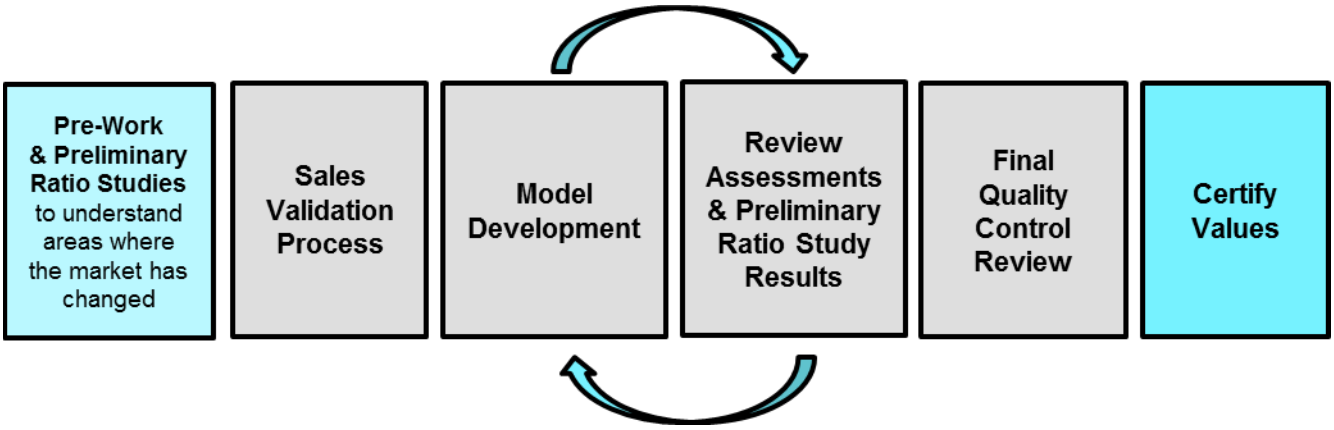
As part of the revaluation process, OPA uses ratio studies to measure how citywide assessments compare to industry standards using standard performance measures that measure uniformity of assessments and equity between lower and higher value properties. OPA's internal ratio study showed that the TY25 revaluation improved the equity, uniformity, and accuracy of single-family property valuations citywide. OPA also retained an outside firm to conduct an external ratio study. The external ratio study also showed that the TY25 revaluation met industry standards and improved metrics citywide. The external ratio study was conducted by Kevin Keene Mass Appraisal Consulting, a consultant with over 30 years of experience in mass appraisal who has conducted ratio studies for large jurisdictions such as Detroit and Buncombe County, North Carolina. Both the internal and external ratio study are posted online at phila.gov/opa.

The following report outlines how OPA assesses values. This document highlights how this process is applied to single family residential properties, which make up roughly 79% (463,981) of the properties in the City as of May 31, 2024.

Key Phases of the 2025 Assessment Process

Following best practices, OPA went through an iterative process to understand and identify areas where the market had changed since the last valuation and how to best reflect any market changes in assessed values of properties before certifying values for Tax Year 2025.

This report provides more detail on these steps.



The Sales Validation Process

Why is Sales Validation Important?

The first step in assessing property values is sales validation. OPA uses sales data to build valuation models. This means that the accuracy of valuation models depends on the accuracy of the sales data. OPA takes a number of steps that are outlined below to ensure that data is accurate.

What is the Sales Validation Process?

OPA examines sale transactions that took place in prior years to determine which sales are valid, arm's-length transactions that should inform valuation models and are the best indicators of the current value of similar properties. OPA uses several years of sales in the modeling process to ensure that there are observations available for all types of property. For the Tax Year 2025 revaluation, sales from January 1, 2018, to June 30, 2023, were eligible for consideration in OPA's process.

The term **arm's length** means that a real estate transaction occurred in an open market arrived at through normal negotiations between an independent buyer and seller.

Some examples of invalid sales are:

- **Non-arm's length transactions**
- **Blanket transactions** where multiple properties transact under a single value and individual values cannot be attributed from the whole.
- Sales reported from the Department of Records that used OPA data to determine a value for Transfer Tax purposes when the **original sales price was not reflective of market value or was a nominal value, such as $1**.

It is important to keep in mind that OPA's assessments will always lag the current market due to the requirement that OPA certify its values in the spring of the year prior to the tax year for which those values take effect.

While OPA examines the most recent sales possible, it also needs time to refine models and perform quality control processes before certifying. OPA also needs a sufficient number of sales to have a representative sample. This means that OPA uses transactions that took place over a multi-year period up to June 30 of the year preceding certification.

As a result, the City's assessments will always lag the current market in the year the taxes are due by 9 months plus the amount of time it takes to refine models and perform quality control processes.

What has OPA Done to Improve the Sales Validation Process?

Prior to the Tax Year 2023 assessment, OPA created and staffed a new sales validation unit. This unit

is responsible for the timely screening and validation of all real estate transfers in the City. This allows OPA to prioritize this work and ensure more consistent review of sales.

Model Development for Mass Appraisal Valuation

What Is Mass Appraisal Valuation?

Mass appraisal is the process of determining property values as of a given date by looking at **sales information** for many properties, **property characteristics**, and **statistical testing**.

To determine a property's value, assessing officers must rely upon valuation equations, tables, and schedules developed through mathematical analysis of market data. The sections below explain why OPA uses mass appraisal.

What Is a Valuation Model?

Any appraisal, whether single-property appraisal or mass appraisal, uses a model. In appraisal, a model is a representation in words or an equation of the relationship between **value and variables representing factors of supply and demand**.

Mass appraisal models attempt to represent the market for a specific type of property in a specified area.

OPA uses **Multiple Regression Analysis (MRA),** a technique for estimating something unknown on the basis of known and available data.

In mass appraisal, the **unknowns are market values**. The **knowns are sales prices**, **income and expense data**, and **property characteristics.**

Unknowns:	**Known & Available Data:**
Market values	Sales prices
	Income and expense data
	Property characteristics

MRA models the relationship between property characteristics and value, so that value can be estimated from a set of known characteristics. MRA is widely used in the assessment industry. Except for unique properties, individual analyses and appraisals of properties are not practical for ad valorem (at value) tax purposes. For more information on **valuation modeling, see the** *IAAO's Standard on Mass Appraisal of Real Property*..

Why Are Models Used in Property Valuation?

Effective valuation models need to do two things:

1. Provide a good estimate for the most typical property and
2. Explain why other properties have different values than the typical property

Because prices for real estate fluctuate for many different reasons, assessment models must be able to account for variance from the typical property.

Models are designed to **produce uniform values** and **minimize errors**.

Mass Appraisal Valuation

OPA starts by **assigning properties to general use classes** based on highest and best use, which normally equates to current use (class examples: single family residential, small multi-family, vacant land, retail, offices, apartment buildings).

Mass appraisal uses models – equations and formulas – that represent the relationship between **value and variables representing factors of supply and demand**. These models seek to represent the market demand for a specific type of property in a specific area (example: a single-family row home in a specific North Philadelphia neighborhood).

Valuation models are developed for defined property groups and market areas.

For residential properties, OPA divides the city into **Geographic Market Areas (GMAs).** This geographic division ("stratification") is appropriate when the value of property attributes varies significantly among areas and each area is large enough to provide an adequate number of sales.

For example, the demand for row homes in Neighborhood X may be greater than in Neighborhood Y; this impacts the value of homes in both areas.

To model residential parcels, the OPA uses several years of sales data and data related to the physical characteristics of the parcels to estimate value using a **comparable sales approach**.

Development of Sub-Markets

Prior to selecting comparable properties, OPA must define the relevant sub-markets for properties — which is a set of properties that would be considered alternates in the mind of the typical buyer of such property. Based on the number of sub-markets in Philadelphia, OPA used 16 geographic zones for single family homes for several reasons:

- Land values, economic conditions, and preferences for various property attributes can vary

based on sub-market.

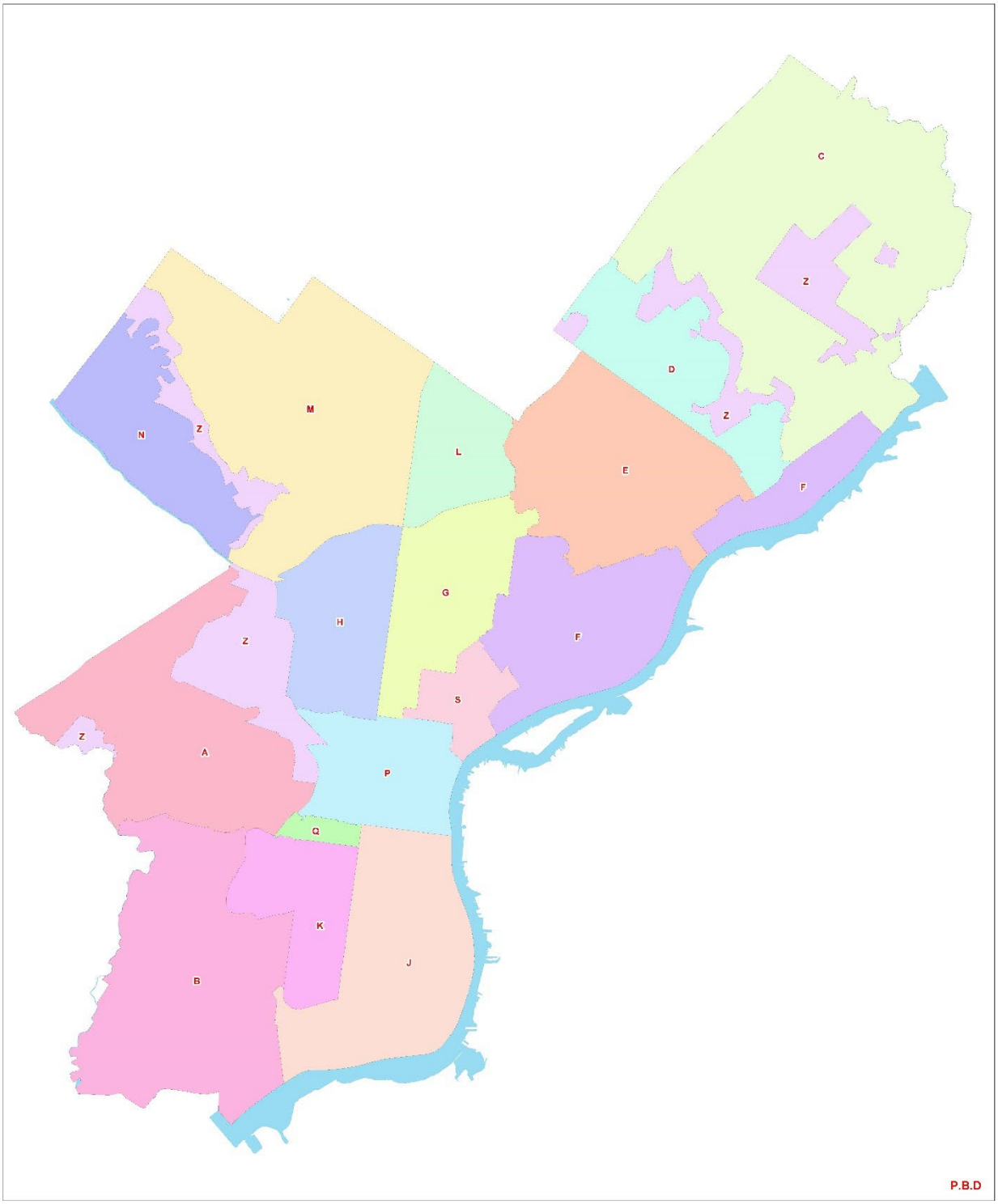
- Modeling by sub-market helps ensure these differences are most accurately reflected in property values.

Variables are entered and tested in a statistical analysis called **regression** to determine if the market(s) recognized "premiums" (i.e. characteristics that would result in higher values) or "penalties" (attributes that would result in lower values). As there are **non-linear relationships** in the contributory value of certain variables, the OPA uses logarithms or exponents for their coefficients.

The models are designed to maximize uniformity as measured in the assessment industry, and to produce a reasonable degree of accuracy in the estimates of value for a specific point in time.

The Zone map used for the Tax Year 2025 assessment is pictured below. For PDF versions of the Tax Year 2025 Zone and GMA maps, see https://www.phila.gov/documents/assessment-methodologies/

ZONE



Zone Map - 2024

OPA - IT / GIS Unit.

August 2024

0 0.375 0.75 1.5 2.25 3 Miles

Legend

- GMA
- RAILROAD
- STREETS
- WARD
- HYDROLOGY
- PARCELS
- FAIRMOUNT PARK

Geographic Market Areas

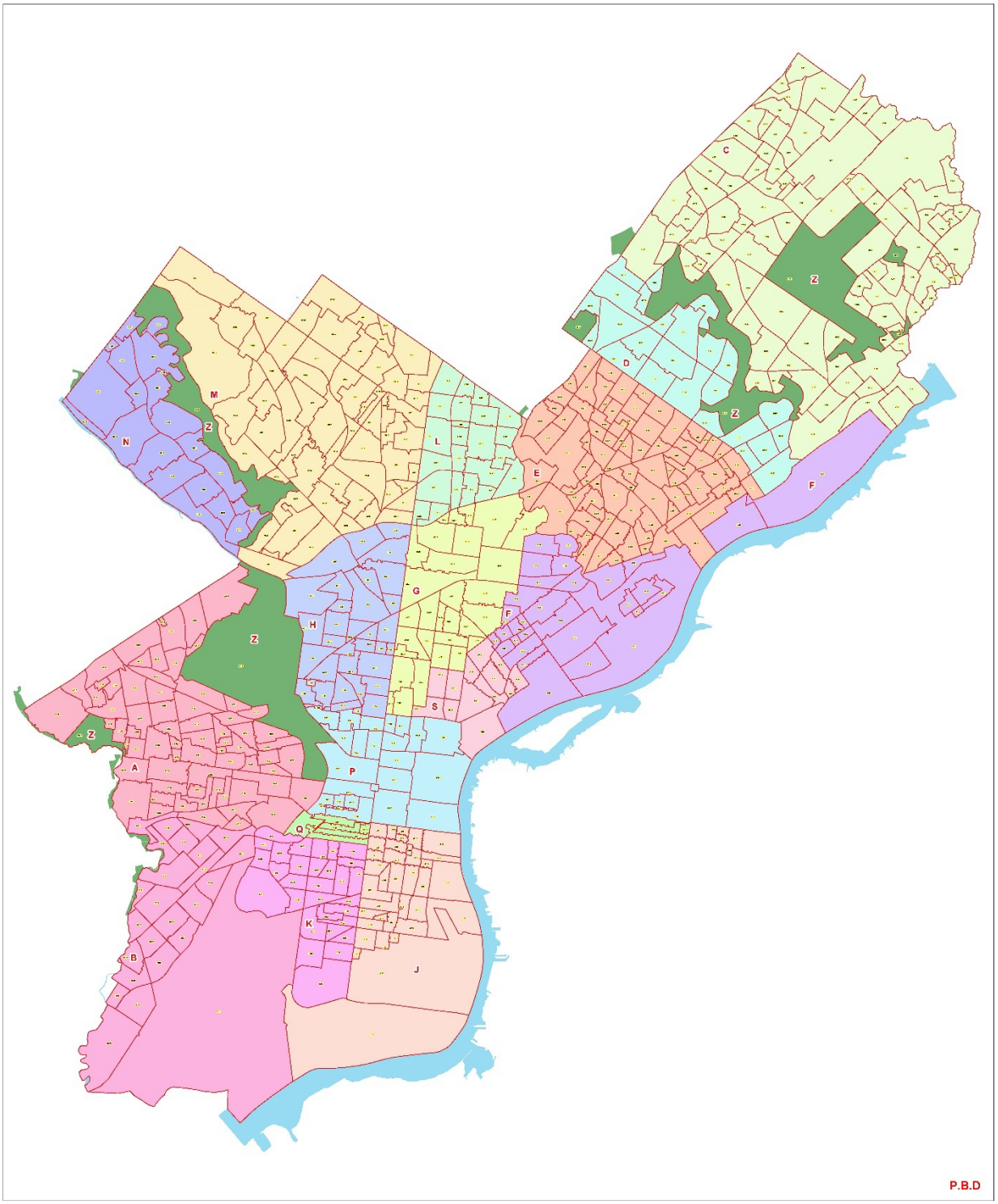
As part of the process for determining property values, OPA review sales data to identify areas of real estate activity where similar properties sell for similar prices. OPA uses this data to create sub-markets called **Geographic Market Areas (GMAs).**

OPA recognizes over 600 residential GMAs within the city. Each parcel lies within a GMA and is assigned to the correct GMA through an automated map-based process.

The **GMA boundaries are reviewed and adjusted as needed each year** to maximize the integrity of the location variables. This is based on analysis of patterns of change in use, price, and sales activity. In OPA models, each GMA is a separate variable that may receive an adjustment in comparison to the most typical GMA.

The GMA map used for the Tax Year 2025 assessment is pictured below. For PDF versions of the Tax Year 2025 Zone and GMA maps, see https://www.phila.gov/documents/assessment-methodologies/

GMA



GMA Map - 2024

OPA - IT / GIS Unit.

August 2024

0 0.375 0.75 1.5 2.25 3 Miles

Legend

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Property Inspections

Properties are inspected to update OPA's records and to give evaluators a high degree of certainty that the property will be valued based on its current characteristics. This is done both in person and by using digital imaging programs.

OPA determines which properties will be inspected based on the last inspection date and indicators that a property may have changed (permits, a sale, appeal, and/or a First Level Review adjustment or inquiry).

Inspections are limited to what can be seen from the curb. Interior inspections are done by owner invitation. This process helps OPA evaluators to collect data on characteristics of properties throughout the City. Other tools, such as permit information from the Department of Licenses + Inspections, aerial and street level photography, and private property listings that describe other characteristics are also used.

Variables Used in Mass Appraisal Valuation

In addition to location, other attributes that have an effect on sales price are included in each model. Physical characteristics that were used in the model included:

- Property style
- Building square footage
- Era built (relative age)
- Lot size
- Garage type and spaces
- Off-street parking (in those neighborhoods where this is determined to bevaluable, such as center city)
- Interior condition (or presumed interior condition)
- Central air
- View amenity
- Proximity to amenities

OPA is only allowed to consider the attributes of each property when estimating value. OPA is **not** permitted to and does not consider attributes such as:

- Income, either of the owner/occupant or the surrounding neighborhood. (In property assessment there, is no such thing as a 'poor' or 'low income' or 'wealthy' neighborhood – only low-priced or high-priced properties)
- Ethnicity of the owner/occupant or the surrounding neighborhood
- Crime statistics
- Length of ownership

- Identity of the owner/occupant
- Any other demographic data

It is illegal for OPA to make any adjustment to value based on data about people.

Time Adjustments

OPA examines **multiple years of sales data** to **ensure a representative sample** when determining property values.

During a multi-year sales analysis period, market conditions may change.

Through regression analysis, OPA builds a compound adjustment index for each model that allows sales from any given month in the sales analysis period to be calibrated to the effective date of appraisal. By adjusting each sale for time, the OPA is able to remove the time adjustment variables from the final iteration of the model.

A sale price from a high point in the market is therefore adjusted downwards to the equivalent in today's prices, while a sale from a low point in the market would be adjusted upwards. Since every sale is adjusted for time, there is no need to 'weight' sales based on the time that they transacted.

Defining a "Typical" Property within Each Model

Each model defines a 'base' or typical property, compares each property to the base, and makes adjustments for the differences.

First, the **regression models** consider all attributes entered, removing the least significant variables one at a time, until all that remains are the variables that contribute significantly to sale price. In this way every model will develop a unique set of base values, adjustment coefficients and time adjustments.

Properties, including those that did not sell, are matched to the appropriate model.

Each property is valued like the base property, and a series of compound multipliers are applied to that (base) value in conformance to the adjustment coefficients for that model.

There is no single formula that is used, as each model will generate a different constant and a different set of adjustment coefficients.

Determining Land Value Allocation

When a structure is present on a property, the total market value reflects the combined value of the building (improvement) and land (residual land).

The **value of the residual land is influenced by the structure on the property**. There is no market for residual land alone, as the land gets its value from its use or potential use. For example, you cannot typically buy the land underneath someone's house, instead you buy the entire property.

OPA is required under state law to calculate the "**contributory value of land,"** or how much of the total property value is attributed to the land *(72 Pa. Stat. Ann. § 5341.7)*. For the Tax Year 2025 assessment, the City used an 80%/20% split in the market value, whereby land value is 20% of the total value and the improvement on the land is 80% of the total for residential properties. This is in alignment with an industry standard around land valuation.

Projecting the Values from a Coefficient File

Each model produces a base value and a set of adjustment coefficients. In order to project values, OPA uses two processes:

1. Within its statistical modeling software, modelers maximize the mathematical accuracy of the projections by measuring the projections against known sales prices and characteristics *at time of sale*.
2. Programming staff uses the base value and adjustment coefficients from each model to perform the same calculations in the property databases for both sold and unsold properties using *current* characteristics.

The basic form of the model is:

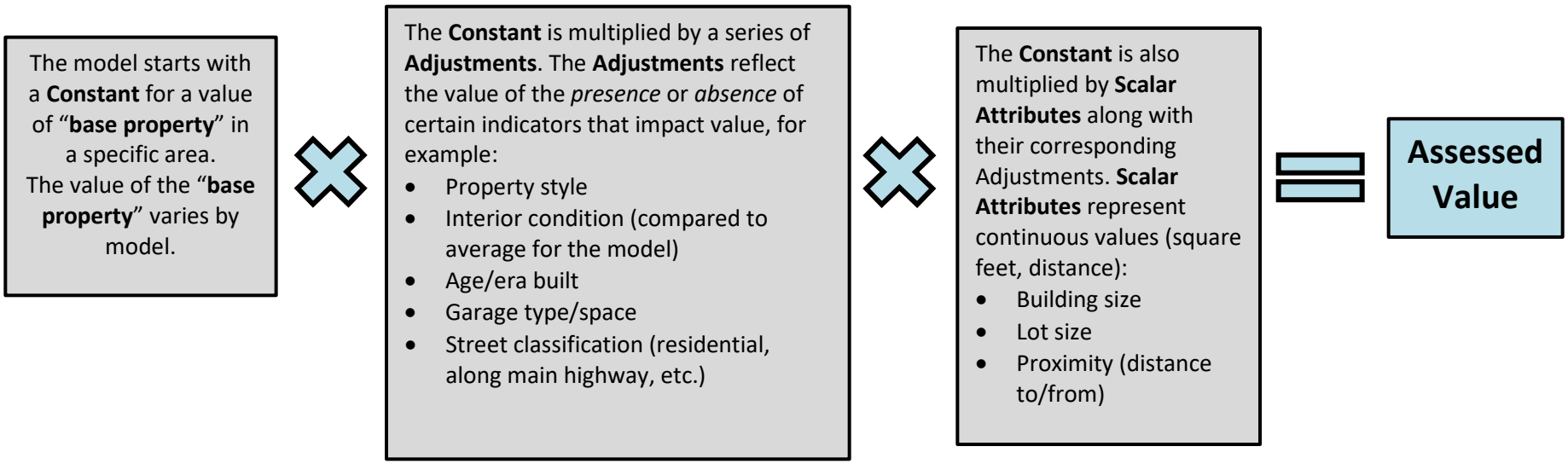
$$\text{Constant} * (\text{Adj Coefficient}_1^{0 \text{ or } 1}) * (\text{Adj Coefficient}_2^{0 \text{ or } 1}) * \ldots (\text{Adj Coefficient}_n^{0 \text{ or } 1}) * (\text{Scalar attribute}_1^{\text{Adj Coefficient}}) \ldots * (\text{Scalar } \textit{attribute}_n^{\textit{Adj}\text{ Coefficient}}) = \text{Assessed Value}$$

How Does the Formula Work?

OPA creates multiple models to help capture market differences in different geographic areas and property classifications across the City.

The values of **constants** and **adjustments** for different attributes will vary across models to reflect differences (example: change in demand, construction costs)

However, each model functions the same way:



Sample Calculation:

123 Main St Philadelphia 19100

Property Characteristics:

CHARACTERISTIC	VALUE	Transformed Scalar	COEFFICIENTS
ZONE	D		12.3310551262586 (CONSTANT)
BLDG SF [S,T]	1333	0.865584415584416	0.327117150216402
LOT SF [S,T]	3750	0.647612468698731	0.0702840049173668
GMA [C]	D241		0
STYLE [C]	SINGLE RANCHER		0.420538325244922
ERABUILT [T,C]	6		0
SIZE [T,C]	2		0.00766469890197572
COND [C]	4		0
GAR TYPE [T,C]	A - BUILT IN		0.0106180057887223
AC [T,C]	Y		0.0385417455373435
SPATIAL [S,T]	10394.08282	0.99853728806335	0.161713716509771

S – Scalar attribute

T – Transformed parameter in Model

C – Categorical attribute

Expanding the basic form for log-log model, the above parcel's coefficients get applied as:

Model Value = EXP(12.3310551262586) * EXP(ln(0.865584415584416 $^{0.327117150216402}$)) *
EXP(ln(0.647612468698731 $^{0.0702840049173668}$)) * EXP(0.420538325244922) *
EXP(0.00766469890197572) * EXP(0.0106180057887223) * EXP(0.0385417455373435) *
EXP(ln(0.99853728806335 $^{0.161713716509771}$))

= **337873.1874**

Truncated to $ 337800 for EV Review

Review of Assessments and Preliminary Ratio Studies

Review by Evaluators

After OPA produces values using the models, market value projections are reviewed by OPA's professional evaluation staff.

During this process the staff reviews any projections that appear to be outliers and have the ability to manually adjust any value that is not reasonable or similar to neighboring properties. For example, the model may generate an extreme value for one property based on its unique characteristics. Evaluation staff may need to make manual adjustments to value the property in line with similar peers and sales but without recalibrating the entire model that works for the majority of properties. This procedure is consistent with industry practices.

Quality Control and Testing

Before OPA certifies final property values, staff applies automated quality control measures to examine outputs and help refine assessment models as well as correct any outliers.

In particular, OPA examines several measures to evaluate the quality of assessments during the modeling process and upon final certification of values to the state.

OPA conducts sales ratio studies to evaluate assessment quality and uniformity, and to serve as a guide for further improvement in future projects. Sales ratio studies compare:

- **Assessments to sales prices.** OPA examines the median, average, and weighted median ratio of assessed value to sale price. The industry standard is 0.90 to 1.10 (90% to 110%). However, OPA targets a median ratio of between 0.95 to 1.02 (95% to 102%), with the goal of ensuring the highest possible accuracy in our assessments.

- **Coefficient of Dispersion (COD).** The COD is the most common measure of uniformity for assessments. This measures the average deviation of all ratios from the median ratio (less than <15% is considered within industry standards for jurisdictions like Philadelphia).

- **Price Related Differential (PRD).** The PRD measures the equity between lower and higher value properties (progressivity < 1.0; regressivity > 1.0). Values between 0.98 and 1.03 are considered within industry standards.

Keene's report on Philadelphia's Tax Year 2025 revaluation found that the Coefficient of Dispersion (COD), Median Ratio, and the Price Related Differential (PRD) were within recommended ranges citywide for single family properties and these measures continue to improve year over year.

Ratio Statistics for FVR.Final_MV/TASP			
Group	Median Ratio	COD	PRD
R	0.991	11.5%	1.014
S	0.99	7.8%	1.009
T	0.997	8.6%	1.011
Overall	0.992	10.8%	1.013

Key	
T	Twins
R	Rows
S	Singles
FinalMV	Final Market Value
TASP	Time Adjusted Sale Price

Source: RATIO STUDY REPORT – CITY OF PHILADELPHIA, JULY 2024 by Keene Mass Appraisal Consulting

State Tax Equalization Board

Each year OPA is required to submit its assessed values to an independent state body, the State Tax Equalization Board (STEB).

STEB reviews the assessed values and sales data to determine how closely each county's values compare to market value as determined by STEB. They publish a Common Level Ratio (CLR) to indicate these results on a percentage basis.

Philadelphia's most recent CLR was 92.61% (2023).

This means that OPA's assessments tracked the market value of sales validated by STEB, and its performance fell within state required guidelines of coming within 15% of the stated CLR (100%).

This also means that OPA's assessments tracked the market value of sales validated by STEB, and its performance fell within 15% of the Pre-Determined Ratio (PDR) (100%).

When a county's PDR differs more than 15% from the CLR, the CLR would be applied in the appeals process after the Board of Assessment Appeals/Revisions establishes a fair market value, based on evidence, to calculate a revised assessment value. The CLR is never used for any other purpose nor used in determining market value.

More information about STEB is available on the Board's website:

https://dced.pa.gov/local-government/boards-committees/tax-equalization-division/