

Riverside County Drives 40% Increase in Model Accuracy for Property Appraisal



Project Objectives

- Integrate and unify data from multiple data sources (e.g., tax assessment system, geospatial characteristics)
- Apply machine learning algorithms to support fair market valuation of residential properties
- Improve accuracy of property appraisals in accordance with Proposition 8
- Improve staff efficiency, allowing appraisers to focus on more complex work

Riverside county is the fourth most populous county in California, home to almost 2.5 million people. The County of Riverside Assessor-County Clerk-Recorder (ACR) office appraises all the real and personal property located throughout the county for the purpose of assessing and collecting property taxes. Riverside county has roughly 980,000 parcels with a total taxable value of \$404 billion. It generated roughly \$4 billion in property taxes for the local government in 2023.

The appraisal process is currently tedious and costly. Appraisers manually aggregate data from many different data sources, apply one or more standard methodologies and use manual tools to produce the market value of a property. Many of the steps required for an appraisal are accomplished using ad-hoc mechanisms that do not capture data in a structured manner.

Results

\$4M

in potential annual economic benefit for residential properties

37%

potential increase in FTE efficiency

40%

improvement in model accuracy, demonstrating ability to automatically enroll 97% of all property sales

8x

reduction in model complexity compared with ACR's previous models

This approach is time-consuming and burdens the already lean team of appraisers. Additionally, valuations are based on opinion of the individual appraisers, which can lead to inconsistent results that have negative impacts when properties are either overvalued or undervalued.

Riverside ACR selected C3 AI Residential Property Appraisal to unify all relevant data in a single view and leverage AI to perform accurate appraisals more quickly. Within 6-months, C3 AI Residential Property Appraisal identified \$4 million in potential annual economic benefit from increased staff efficiencies and appraisal accuracy improvements. C3 AI Residential Property Appraisal also improved property valuation model accuracy by 40%, with an 8x reduction in model maintenance overhead compared to Riverside ACR's previous models.

Challenges

The process of manual appraisals is lengthy and takes a considerable amount of time. Every year, Riverside ACR office reappraises all parcels in the County that underwent appraisal trigger events per the California constitution.

In 2022, 125k residential parcels in Riverside County were reappraised – triggered by

1. **Change in ownership:** 58% of property reappraisals were triggered due to change in ownership. This includes both arm's length transfers well as zero-sale price transfers. Riverside ACR has set criteria to determine if the property is eligible for direct enrollment (DE). In 2022, of all the properties triggered due to change in ownership, 67% were DE-eligible transfers.
2. **Proposition 8 Decline:** 34% of property reappraisals were triggered due to decline in value.
3. **New Construction:** 8% of appraisals were for new constructions.

Riverside ACR uses linear-regression models as the automated valuation models (AVM) to appraise the DE-eligible transfers. A property is auto-appraised (i.e., directly enrolled) at its sales price if the sales price was within +/- 25% of the AVM prediction. Riverside ACR automatically appraised 80% of the DE-eligible transfers while the other 20% required manual appraisals. After intensive manual appraisals, most of these properties ended up being enrolled at the sales price, suggesting low accuracy of these linear-regression models.

Transfers with a zero-sale price (i.e., a change in ownership without a sales value) are difficult to assess and require manual appraisals which can lead to inconsistent valuations being generated across appraisers.

Properties that qualify for California Proposition 8 must be revalued every year. Given limited resources and time, county appraisers use simple rule-based blanket adjustments for all properties in the county. These broad adjustments can lead to overvalued or undervalued properties, which can have negative impacts to the public or the county.

Additional challenges include:

- **Data Cleaning:** The cleaning of data is a tedious process for Riverside, involving several internal and external data sources.
- **Model Maintenance:** Manual regression model maintenance requires significant effort to calibrate, maintain and catalog.
- **Inability to Bulk-Accept Appraisals:** The ability to mass update properties with common features is missing.
- **Inflexible User Experience:** Current systems offer limited flexibility and do not support continuous real-time analytics processing.



About Riverside County

- ~2.5 million residents
- ~1 million properties
- ~980k parcels reported, with total taxable value of ~\$404 billion
- 60% of the county's parcels represent residential properties with a total taxable value of \$229 billion

Project Highlights

- 6-month timeline from project kickoff to completion
- 100M+ data points integrated from 3 source systems
- 460k residential single-family dwellings and condominiums in scope
- 2 ML models configured on a quarterly basis to generate fair market values for in-scope properties
- 30+ model features identified, including at least 15 new features that were not used in ACR's previous valuation models
- Increase in valuation accuracy as compared previous methods
 - 30% increase in the number of properties with valuations that fall within 5% of the actual sale price
- Up to 97% direct enrollment of all sales within Riverside County
- 8x reduction in model maintenance overhead
- Fully met all International Association of Assessing Officers (IAAO) guidelines for Automated Valuation Models (AVM) performance
- 90% reduction in the time required to recalibrate its valuation models every quarter, from approximately 40 days to 4 days

Approach

C3 AI configured and deployed the C3 AI Residential Property Appraisal application for Riverside ACR for approximately 460,000 residential single-family dwellings and condominiums in four districts of West Riverside County – including Temecula, Perris, Hemet, and Riverside, in less than 6-months. The goal of this production pilot was to demonstrate how C3 AI Residential Property Appraisal could improve help staff gain transformative efficiencies, while drastically reducing the complexity of its current modeling approach.

The team began by ingesting, cleansing, and unifying over 100M+ data values across two source systems – tax assessment system (CAMA) and geospatial (GIS). This unified data image consisted of both real-time and historical building, land, and site information spanning several years. The team established bi-directional integration with the CAMA system enabling an up-to-date data image. This unified data image also formed the foundation to apply AI to property appraisal to efficiently produce more fair, defensible, and accurate valuations.

To create an accurate model that predicts the market value of a property, C3 AI's team experimented with 9 machine learning models to find one uniquely suited for the county's use case, ensuring that approximately 80% of the model's predictions sit within a tight 10% accuracy range while also meeting IAAO guidelines for price-related differential (PRD) and co-efficient of dispersion (COD).

To build the model, the team created over 30 machine learning (ML) features including home living area, age, distance to schools, condition, and sales prices for comparable properties, among others. The model applied advanced feature selection techniques to identify and exclude features that did not contribute significantly to model performance, thereby enhancing interpretability and explainability of the automated valuations.

Finally, the C3 team built a rich user interface (UI) with eight workflow-enabled UI screens to help the county assessors and leadership visualize the insights provided by the machine learning model, across all of their properties

- **Manager Overview:** provides managers with relevant KPIs on progress towards completing roll for a given year.
- **Appraiser dashboard:** shows appraisers tactical details on the number of transfers and declines pending that require review.
- **Properties search:** enables users to search for specific properties, triage using a rich filter panel and trigger data cleaning workflow.
- **Property detail:** displays key property characteristics, historical events and photos. Users can sanitize property's condition based on photos.
- **Transfers:** provides grid and map visualization for all transfer properties with a rich filter panel, allows users to bulk conclude assessment values or navigate to individual transfer event details.
- **Decline in value:** provides grid and map visualization for all Proposition 8 properties with a rich filter panel, allows users to bulk conclude AVM-predicted assessment values or navigate to individual decline event details.
- **Model Operations:** allows users to visualize and inspect ML models and key ML model metrics.
- **Admin:** enables managers to configure holding periods, define thresholds of AVM variances or priority status and schedule running AVM models for declines.



Solution Architecture

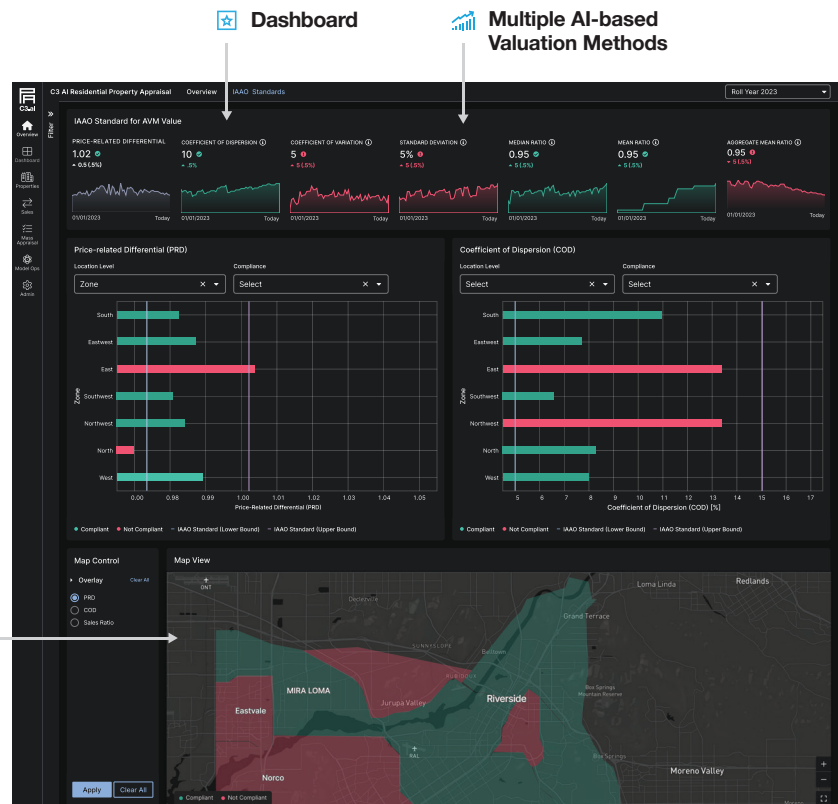
C3 AI Residential Property Appraisal

Enterprise Data

- Computer Assisted Mass Appraisal (CAMA)
- Geographic Information System (GIS)



Map View



Benefits

By using the C3 AI Residential Property Appraisal application, the county is able to:

Realize

economic benefits of \$4M per year

Increase

full-time equivalent (FTE) efficiency by 37% by allowing appraisers to appraise properties more quickly

Automate

the tedious and costly process of data aggregation necessary to complete a property appraisal

Apply

the power of AI to produce highly accurate appraisals consistent with best practices

Reduce

the time and cost to complete accurate property valuations for assessment purposes

Provide

fairer and more defensible valuations

Proven Results in 6-Month Pilot

Visit C3.ai/get-started