

MARS- Modeling Introduction

MARS- **M**odeling **A**nalysis **ReS**ource

An introduction to model specification and calibration and to a tool called MARS.

This tool is designed to help bridge the gap between modeling theory and the construction of your formulas and/or tables.

MARS- Modeling Introduction

MARS- **M**odeling **A**nalysis **ReS**ource

We will cover:

- Modeling Introduction
- Modeling General Overview
- Model Types
- Decisions Within the Modeling Process
- Data Types and Variables
- Property Characteristics
- MARS Demonstration

Introduction

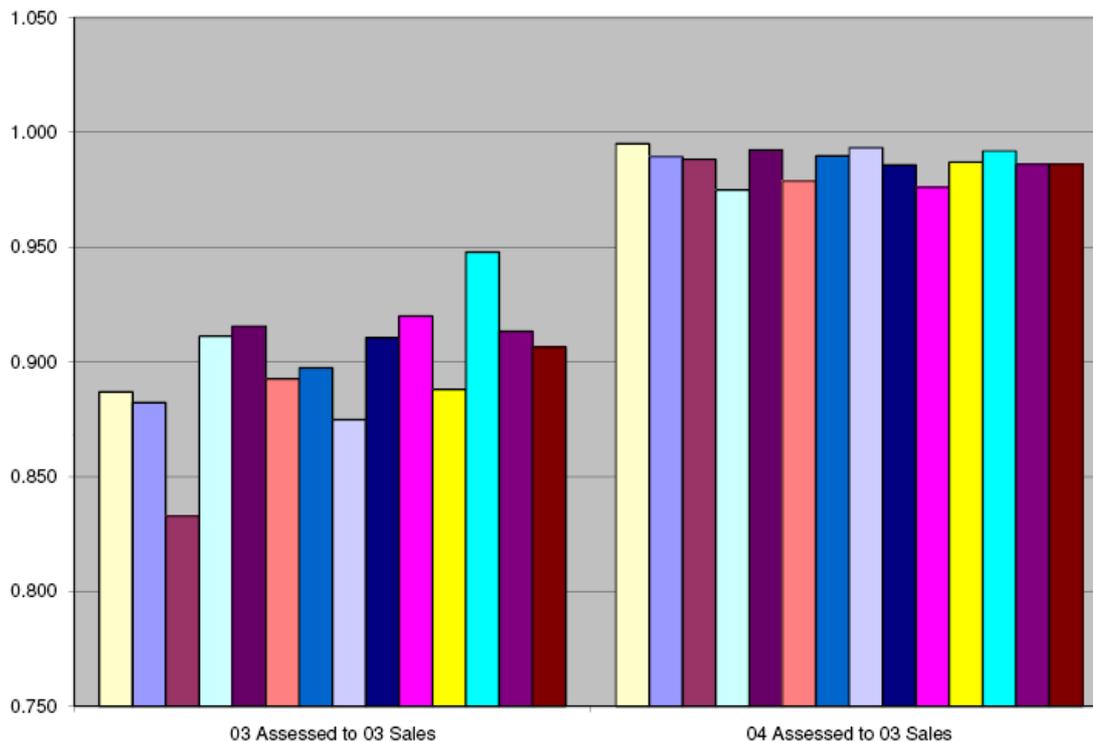
- Remember this is geared to those who are starting from scratch.
- This may seem overly simplified or basic if you already have a CAMA system with tables and formulas built in and are already doing mass appraisal. (What we will cover still is applicable because you should be calibrating that system each year.)
- Put yourself in a different set of shoes. Image if all of that was taken away from you overnight and you had to put a system together from nothing. That is what some of our counties are facing.
- The seminar today and the MARS tool are not meant to present a sophisticated or advanced system (we have had full blown modeling classes using statistical packages for that) but today is meant to be a basic bridge from theory to practical application; to help you think about formulas and tables and to do so without the “black boxes.”

MARS- Modeling Introduction

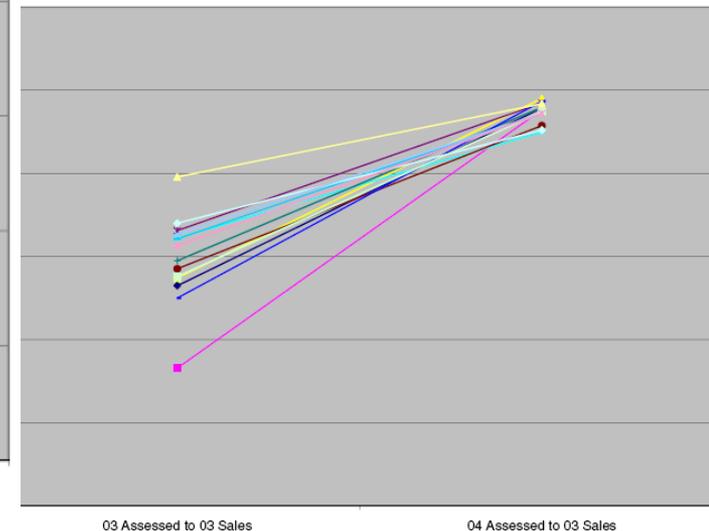
Why Model?

- Mass Appraisal relies on models.
- Can gain efficiencies through Mass Appraisal.
- Can gain greater uniformity through Mass Appraisal.

Assessed Value to Sales Ratios



Assessed Values to Sales Ratios



MARS- Modeling Introduction

A Quick Note About Modeling

- Don't let modeling "scare" you.
- Every appraiser does modeling. (The factors that you adjust for in an appraisal is a model.)
- Models are used in all three approaches to value.
- Modeling is simply a way of reflecting the market and its influences.
- It is a description of observed patterns.
- It can be simple or complex.
- "A model is a representation of how something works."
(IAAO)
- "Models may be physical, conceptual, or mathematical."
(IAAO)
- "Model building requires good theory, data analysis and research methods." (IAAO)
- "The best valuation models will be accurate, rational, and explainable." (IAAO)

Modeling Examples

Uniform Residential Appraisal Report

File #

The purpose of this summary appraisal report is to provide the lender/client with an accurate, and adequately supported, opinion of the market value of the subject property.

Property Address	City	State	Zip Code
Borrower	Owner of Public Record	County	
Legal Description			
Assessor's Parcel #	Tax Year	R.E. Taxes \$	
Neighborhood Name	Map Reference	Census Tract	
Occupant <input type="checkbox"/> Owner <input type="checkbox"/> Tenant <input type="checkbox"/> Vacant	Special Assessments \$	<input type="checkbox"/> PUD HOA \$	<input type="checkbox"/> per year <input type="checkbox"/> per month
Property Rights Appraised <input type="checkbox"/> Fee Simple <input type="checkbox"/> Leasehold <input type="checkbox"/> Other (describe)			
Assignment Type <input type="checkbox"/> Purchase Transaction <input type="checkbox"/> Refinance Transaction <input type="checkbox"/> Other (describe)			
Lender/Client	Address		
Is the subject property currently offered for sale or has it been offered for sale in the twelve months prior to the effective date of this appraisal? <input type="checkbox"/> Yes <input type="checkbox"/> No			
Report data source(s) used, offering price(s), and date(s).			

C O N T R A C T	I <input type="checkbox"/> did <input type="checkbox"/> did not analyze the contract for sale for the subject purchase transaction. Explain the results of the analysis of the contract for sale or why the analysis was not performed.		
	Contract Price \$	Date of Contract	Is the property seller the owner of public record? <input type="checkbox"/> Yes <input type="checkbox"/> No Data Source(s)
	Is there any financial assistance (loan charges, sale concessions, gift or downpayment assistance, etc.) to be paid by any party on behalf of the borrower? <input type="checkbox"/> Yes <input type="checkbox"/> No If Yes, report the total dollar amount and describe the items to be paid.		

Note: Race and the racial composition of the neighborhood are not appraisal factors.

N E I G H B O R H	Neighborhood Characteristics	One-Unit Housing Trends	One-Unit Housing	Present Land Use %
	Location <input type="checkbox"/> Urban <input type="checkbox"/> Suburban <input type="checkbox"/> Rural	Property Values <input type="checkbox"/> Increasing <input type="checkbox"/> Stable <input type="checkbox"/> Declining	PRICE	AGE
Built-Up <input type="checkbox"/> Over 75% <input type="checkbox"/> 25-75% <input type="checkbox"/> Under 25%	Demand/Supply <input type="checkbox"/> Shortage <input type="checkbox"/> In Balance <input type="checkbox"/> Over Supply	\$ (000)	(yrs)	2-4 Unit %
Growth <input type="checkbox"/> Rapid <input type="checkbox"/> Stable <input type="checkbox"/> Slow	Marketing Time <input type="checkbox"/> Under 3 mths <input type="checkbox"/> 3-6 mths <input type="checkbox"/> Over 6 mths	Low		Multi-Family %
Neighborhood Boundaries		High		Commercial %
		Pred.		Other %
Neighborhood Description				

Modeling Examples

Uniform Residential Appraisal Report

File #

There are _____ comparable properties currently offered for sale in the subject neighborhood ranging in price from \$ _____ to \$ _____
 There are _____ comparable sales in the subject neighborhood within the past twelve months ranging in sale price from \$ _____ to \$ _____

FEATURE	SUBJECT	COMPARABLE SALE # 1			COMPARABLE SALE # 2			COMPARABLE SALE # 3		
Address										
Proximity to Subject										
Sale Price	\$ _____	\$ _____	\$ _____	\$ _____	\$ _____	\$ _____	\$ _____	\$ _____	\$ _____	
Sale Price/Gross Liv. Area	\$ _____ sq. ft.	\$ _____ sq. ft.	\$ _____ sq. ft.	\$ _____ sq. ft.	\$ _____ sq. ft.	\$ _____ sq. ft.	\$ _____ sq. ft.	\$ _____ sq. ft.	\$ _____ sq. ft.	
Data Source(s)										
Verification Source(s)										
VALUE ADJUSTMENTS	DESCRIPTION	DESCRIPTION	+(-) \$ Adjustment	DESCRIPTION	+(-) \$ Adjustment	DESCRIPTION	+(-) \$ Adjustment	DESCRIPTION	+(-) \$ Adjustment	
Sale or Financing Concessions										
Date of Sale/Time										
Location										
Leasehold/Fee Simple										
Site										
View										
Design (Style)										
Quality of Construction										
Actual Age										
Condition										
Above Grade	Total Bdms. Baths	Total Bdms. Baths		Total Bdms. Baths		Total Bdms. Baths		Total Bdms. Baths		
Room Count										
Gross Living Area	sq. ft.	sq. ft.		sq. ft.		sq. ft.		sq. ft.		
Basement & Finished Rooms Below Grade										
Functional Utility										
Heating/Cooling										

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Modeling Examples

COST APPROACH TO VALUE (not required by Fannie Mae)

Provide adequate information for the lender/client to replicate the below cost figures and calculations.

Support for the opinion of site value (summary of comparable land sales or other methods for estimating site value)

C O S T A P P R O A C H	ESTIMATED <input type="checkbox"/> REPRODUCTION OR <input type="checkbox"/> REPLACEMENT COST NEW	OPINION OF SITE VALUE = \$			
	Source of cost data	Dwelling	Sq. Ft. @ \$ = \$	
	Quality rating from cost service	Effective date of cost data	Sq. Ft. @ \$ = \$	
	Comments on Cost Approach (gross living area calculations, depreciation, etc.)				
		Garage/Carport	Sq. Ft. @ \$ = \$	
		Total Estimate of Cost-New = \$			
		Less	Physical	Functional	External
		Depreciation		 = \$()
		Depreciated Cost of Improvements..... = \$			
		"As-is" Value of Site Improvements..... = \$			
Estimated Remaining Economic Life (HUD and VA only)	Years	Indicated Value By Cost Approach = \$			

INCOME APPROACH TO VALUE (not required by Fannie Mae)

Estimated Monthly Market Rent \$ X Gross Rent Multiplier = \$ Indicated Value by Income Approach

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

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Modeling Examples



SQUARE FOOT APPRAISAL FORM

For subscribers using the *Residential Cost Handbook* and /or *Estimating Products* Estimate Number: 609

Property Owner _____		Date _____	
Address _____		Surveyed By _____	
City _____		Cost as of <u>December, 2006</u>	
State/Province <u>WA</u>	Zip/Postal Code _____	Appraisal For _____	

Type <u>Single-family Residence</u>	Quality <u>3.00</u> Average	Total Floor Area <u>1,874</u>
Style <u>One Story 100%</u>		Number of Units _____
Exterior Walls <u>Frame, Siding 100%</u>		Interior Wall Height <u>8</u>
Age <u>6</u> Condition <u>4.50</u> Good/Very Good	Region <input checked="" type="checkbox"/> Western <input type="checkbox"/> Central <input type="checkbox"/> Eastern	Basement Depth _____

		Factor	Quantity	Cost	Extended Cost
1. COMPUTE RESIDENCE BASIC COST	Wall Height Factor X Floor Area X Selected Sq. Ft. Cost	1.000	1,874	74.48	\$ 139,576
Square Foot and Lump Sum Adjustments					+ -
2. Roofing	Composition Shingle		1,874	0.08	+ 150
3. Energy:	<input checked="" type="checkbox"/> Mild <input type="checkbox"/> Moderate <input type="checkbox"/> Extreme <input type="checkbox"/> Superinsulated		1,874	-1.13	- (2,118)
4. Foundation:	<input checked="" type="checkbox"/> Mild <input type="checkbox"/> Moderate <input type="checkbox"/> Extreme Hillside: <input checked="" type="checkbox"/> Flat <input type="checkbox"/> Moderate <input type="checkbox"/> Steep		1,874	-2.30	- (4,310)
5. Seismic:	<input checked="" type="checkbox"/> None <input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 Wind: <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes				
6. Subfloor	Raised Subfloor				
7. Floor Insulation:	<input type="checkbox"/> Mild <input type="checkbox"/> Moderate <input type="checkbox"/> Extreme				
8. Floor Cover	Floor Cover Allowance		1,874	3.20	+ 5,997
9. Plaster Interior					
10. Heating/Cooling	Heat Pump		1,874	2.28	+ 4,273
11. Plumbing Fixtures:	Total 10 Base 8		2	1,100.00	+ 2,200
12. Plumbing Rough-ins:	Total 1 Base 1				
13. Dormers					
14. Fireplaces					

Modeling Examples

Depreciation Report

Single-family Residence
 Effective Age: 6
 Cost as of: December, 2006
 Style: One Story
 Exterior Wall: Frame, Siding 100%
 Plumbing Fixtures: 10

Floor Area: 1,874 Square Feet
 Quality: 3 Average
 Condition: 4.5 Good/Very Good

	Units	Unit Cost	Total Cost New	Less Depreciation	Total Cost Depreciated
Base Cost	1,874	56.58	106,031	5,302	100,729
Plumbing Fixtures	10	1,155.00	11,550	578	10,972
Composition Shingle	1,874	2.18	4,085	204	3,881
Raised Subfloor	1,874	7.29	13,661	683	12,978
Floor Cover Allowance	1,874	3.36	6,297	315	5,982
Heat Pump	1,874	5.85	10,963	548	10,415
Plumbing Rough-ins	1	472.50	473	24	449
Appliance Allowance	1	2,703.75	2,704	135	2,569
Basic Structure Total Cost	1,874	83.12	155,764	7,789	147,975
Attached Garage	480	23.28	11,174	559	10,615
Subtotal Garage			11,174	559	10,615
Enclosed Porch, Knee Walls w/ Glass	374	38.61	14,440	722	13,718
Wood Deck with Roof	992	20.20	20,038	1,002	19,036
Machine Shed/0	864	6.85	5,918	296	5,622
Met Pole w/loft	288	18.31	5,273	264	5,009
Met Pole/c	144	16.04	2,310	116	2,194
Lean Tos	864	4.77	4,121	206	3,915
Met Pole/c	2,400	16.04	38,496	1,925	36,571

Common Fields Needed for Modeling and Mass Appraisal

<u>Field</u>	<u>Description</u>
<u>GENERAL/ADMINISTRATIVE</u>	
Parcel ID Number (PIN)	Unique number identifying each particular parcel
Sale Date	
Sale Price	
Adjustment	Adjustments to Sale Price
Adjusted Sale Price	
Market/Non-Market Sale	Market Sale / Non-Market Sale Code
Notations	Notations field where adjustments or non-market designations can be explained.
Assessment Year	
Assessed Value for Land	
Assessed Value for Improvements	
Total Assessed Value	
Legal	Legal Description of Property
House Number	Situs/Address- House Number
Street	Situs/Address- Street
City	Situs/Address- City
State	Situs/Address- State
Zip Code	
Buyer Name	
Seller Name	
Excise Tax Number	

Common Fields Needed for Modeling and Mass Appraisal

Land Characteristics (or commonly associated with land but may effect both)

Property Usage Type

Property Zoning

Neighborhood

Acreage

Frontage Type

Front Footage

Bank Type

Property/Parcel Shape

Topography

View Type

View Quality

Privacy

Services

Services as in Utilities/Site Improvements

Subdividable

Subdividability of parcel

Site Utility

Usability or use factor

Site Access

Corner Lot

Traffic Level

Street Attributes

Agricultural Land Characteristic

Ag Land Valuation Characteristic- Different Counties Use Different Characteristics

Common Fields Needed for Modeling and Mass Appraisal

Improvement Characteristics

Year Built

Effective Age

Depreciation

Condition

Quality

Square Footage

Style/Stories

Bedrooms

Baths

Basement SF

Basement Finish

Garage SF

Garage Finish

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General Overview of Model Process

- **Models are used with all three approaches to value.**
 - **Cost Approach**
 - **Market (Sales Comparison) Approach**
 - **Income Approach**
- **A common approach within CAMA systems is a Modified Cost Approach which starts with a Cost Approach and then adjusts the factors based on market analysis.**
- **Remember-**
- **Even though you are using a CAMA system, mass appraisal and modeling you must consider all three approaches to value.**

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General Overview of Model Process

- **Specification**

- **Is critical**
- **“First” step**
- **Should be reviewed continually after being completed as you are doing your calibration.**
- **In selecting variables for your model and in selecting your model consider the measures of dispersion. Low measures of dispersion indicate a better model.**

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General Overview of Model Process

- **Specification Includes**

- **Hypothesis- Expectations and thoughts as to what the major factors contributing to value in your market.**
- **Data collection**
- **Analysis of Market**
- **Construction of Model(s)**
- **Testing**
- **Selection and Refinement of final model(s)**

- **Calibration Includes**

- **Annual market analysis and testing of model**
- **Refinement and adjustment of model**
- **Testing of model adjustments**

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Model Types

(An attempt to put them into plain English)

- **Additive**

- **Multiply Variable by Coefficient and add to a constant or base value**
- **Base + (SF x coefficient) + (Quality x coefficient)**
- **$\$23,940 + (1800 \times \$34.20) + (1.00 \times \$5,880) = \$91,380$**

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Model Types

(An attempt to put them into plain English)

- **Multiplicative**

- **Variables are:**

- raised by powers or
- serve as powers

- **Results are multiplied**

- **Base x SF to a power x Quality to a power**

- **$58.28 \times 1800^{0.988} \times 1.00^{1.09} = \$95,880$**

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Model Types

(An attempt to put them into plain English)

- **Hybrid**
 - **Incorporates both Additive and Multiplicative Model Types**

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Model Types

(An attempt to put them into plain English)

Additive and Multiplicative Side by Side

- **Model Involving Base and SF and Quality**
- **Additive**
 - $\$23,940 + (1800 \times \$34.20) + (1.00 \times \$5,880) = \$91,380$
- **Multiplicative**
 - $\$58.28 \times 1800^{0.988} \times 1.00^{1.09} = \$95,880$

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Decisions Within the Model Process

- **Above Model Types Can Be Used In**
 - **Cost Models**
 - **Sales Comparison Models**
 - **Income Models**

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Decisions Within the Model Process

- **Model Form**
 - **Formula/Equation**
 - **Table**
 - **Hybrid**

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Decisions Within the Model Process

- **Calibration Methods**

- **MRA (Multiple Regression Analysis)**
 - Not desirable for small samples or populations
 - Can not directly calibrate a hybrid model, used with multiplicative models
- **AEP (Adaptive Estimation Procedure) or Feedback**
 - Basically what MARS will use
 - Good for Hybrid Models
- **Location Value Response Surface Analysis**
 - Used with MRA and AEP

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Data Types and Variables

- **Data Types for your Variables**
 - **Quantitative (Acreage, SF)**
 - **Qualitative (Improvement Quality, Effective Age)**
 - **Continuous or Scaler (Quantitative) (Acreage)**
 - **Binary (Quantitative) (Yes or No)**
 - or sometimes Qualitative converted to Quantitative
 - **Discrete (Qualitative) (Street Attributes)**

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Data Types and Variables

- **Other Data Types or Categories**

- **Objective (Verifiable)**
- **Subjective (Opinion)**

- **General Data- Economic, Social, Environmental, Governmental**
- **Specific Data- Lot Size, Shape, Topography**
- **Comparative Data- Costs, Wages, Sale Dates, Expenses, Vacancy Rates**

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Data Types and Variables

- **Variables**

- **Identify them**
- **Independent and Dependent - Sales Price (dependent) is influenced by topography (independent).**
- **Determine Weighting**
- **Steps vs Coefficients**
- **Positive Correlation (when one increases the other increases)**
- **Negative Correlation (When one increases the other decreases)**
- **Want high correlation between dependent and independent**
- **Want low correlation between independent variables**

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Keys to Successful Modeling

Specification & Selection of Model

Quality of Your Data

Quality of Analysis

Property Characteristics

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Property characteristics are important for:

- Arriving at Assessed Values utilizing Mass Appraisal
- Analysis of Assessed Values
- Market Analysis
- Model Specification and Calibration

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Property Characteristics

Characteristics typically fall into three general categories of impact.

Those that influence the value of:

- Land
- Improvements
- Either / Both

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Let's look at the concept that some characteristics may impact both land and improvements.

As we look at this keep in mind the concept of Highest and Best Use

IAAO definition- Highest and Best Use- A concept in appraisal and in assessment law requiring that each property be appraised as though it were being put to its most profitable use, given probably legal, physical, and financial constraints.

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Also keep in mind the concept of External Obsolescence.

In addressing Economic or **External Obsolescence** IAAO states that “an undesirable location can affect land as well as improvement values, but the effects should be separated because land value, calculated from the market, already reflects this influence.” **Property Appraisal and Assessment**

Administration p.221

External Obsolescence addresses a negative influence on value but the corollary is also true that property characteristics can positively influence both land and improvement values.

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Consider Zoning

- Being zoned residential versus commercial clearly may affect the land value.
- An example- consider a commercial grade shop building restricted to personal use that due to a zoning change can now be used for commercial purposes. Might that increase its value?
- Going the other direction- If someone managed to build a small office building on a residential lot and it legally could not be used for commercial purposes, it would be expected that the value of the improvements would be affected.

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Now Lets Consider View

- Often considered to only affect land.
- You've probably heard the statement "An improvement has the same value regardless of which lot it is on. Any difference is in the land."
- While the COST of constructing two identical houses in close proximity may be the same, the MARKET VALUE may not be identical.
- There may be intrinsic value from a characteristic of the land that projects onto the improvements.

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Now Lets Consider View – An Example

As a practical example consider two homes-

- Built in the same development
 - Built by the same builder
 - Built at the same time
 - Identical floor plans
 - Of good quality with many large picture windows
- One looks out across a sweeping valley and a dynamic mountain range.
 - The other looks out on a old car junk yard.

Would you pay the same amount for both of them?

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Lets Consider Neighborhood Influence

What about a very good quality home built in a fair quality neighborhood. (This is referred to as **Economic Obsolescence** also called External Obsolescence or Locational Obsolescence.)

Would that very good quality home have the same value surrounded by fair quality homes as it would surrounded by other very good quality homes? Not likely.

This is an example of location (or neighborhood) influencing improvement value.

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What does this mean for my analysis and my valuation models?

This is mentioned here because in doing mass appraisal, market analysis and model specification and calibration you may find a property characteristic that mostly or typically is attributed to land that if you apply the adjustment only to the land you end up with a disparity when compared to vacant land sales.

To have your land values match up with your vacant land sales you may need to apply some of that characteristics influence to the improvements.

The basic question is, “What is the Market indicating?”

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- Now we will take a look at characteristics that typically influence value-
 - Characteristics affecting land value, improvement value or both.
- Remember
 - This is just an overview. These are common characteristics but not an exhaustive list.
 - You need to constantly analyze your market to see which characteristics are influencing value in your market and to what degree.

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- Identification of Characteristics is Critical to Mass Appraisal, Modeling and Analysis.
 - Characteristics that are currently influencing value
 - Characteristics that need to be tracked and analyzed because they might influence value or might be important for stratification or categorization of property

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Characteristics That Typically Influence Land Value

- Zoning
- Neighborhood
- Acreage
- Topography
- Frontage
- Bank Type
- Shape
- View
- Privacy
- Subdividability
- Site Utility (use)
- Access
- Corner
- Traffic
- Street Attributes
- Agricultural Considerations

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Characteristics That Influence Improvement Value

Primary

- Year Built
- Effective Age / Condition
- Quality
- Size / SF
- Style

Secondary

- Number Bathrooms
- Number Bedrooms
- Garage / Carport
- Basements
- Outbuildings

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Characteristics That May Influence Both Land and Improvements

- Zoning
- Neighborhood / Location
- Frontage
- View
- Access
- Traffic
- Street Attributes
- **Services** (Utilities) (Some consider part of land while others consider part of improvements.)

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- Once the characteristics are identified another important step is determining how you are going to capture those characteristics for use in analysis and your assessed values.
- So, lets look at:
 - Ways to “Value” of those Characteristics
 - Scaling Options

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If we are looking at characteristics “manually” then words (alphabetical or textual descriptions) are often used. For example improvement quality might be labeled as:

- Poor
- Fair
- Moderate (or Average)
- Good
- Excellent

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However, if we want to be able to analyze the market using statistical measures and ratio studies and if we want to be able to utilize the characteristics influence in modeling and formulas, then we need to represent those characteristics numerically.

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So, we use a numeric scale to represent the characteristics value.

Alpha	Numeric
Poor	1.0
Fair	2.0
Average (Moderate)	3.0
Good	4.0
Excellent	5.0

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In using a numeric scale one of the decisions is how refined you are going to make your grading.

Alpha	Full Step	Half Step	Quarter Step
Average (Moderate)	3.0	3.0	3.0
			3.25
Avg + / Good (-)		3.5	3.5
			3.75
Good	4.0	4.0	4.0

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Dealing with an alpha label in Excel

If your data source includes alpha labels

- Best option is to convert your CAMA system to include a numeric field which it can export.
- You can use the Replace Function within Excel to convert to a numeric value.
 - Can be time consuming.
 - Can lead to errors if not careful. (Maybe even if you are careful.)
- You can build formulas to automate the conversions.
 - May take more time initially but save time in the long run.
 - Is less prone to errors once it is built and tested.

Review

So far we have touched on-

- the importance of modeling
- the wide range of possibilities for your model type and form
- that your model specification and selection is critical, like a foundation
- that the quality of your data is important, like the quality of materials in a home
- that the quality of your analysis is important and could be compared to the quality of the craftsmanship of a homes construction

Review

A way to remember keys to modeling:

- For construction- Quality of Foundation, Materials, and craftsmanship
- For your model- Quality of Specification, Data and Analysis

Review

We also reviewed the other very important component of your model, property characteristics.

- That they can effect land, improvements or both
- Identifying, tracking and quantifying them is critical to mass appraisal
- If there are key characteristics that are influencing the market that you are not capturing and do not have in your model
 - will lead to difficulty in calibrating your model
 - will negatively influence the uniformity of your assessments

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Thank you !