

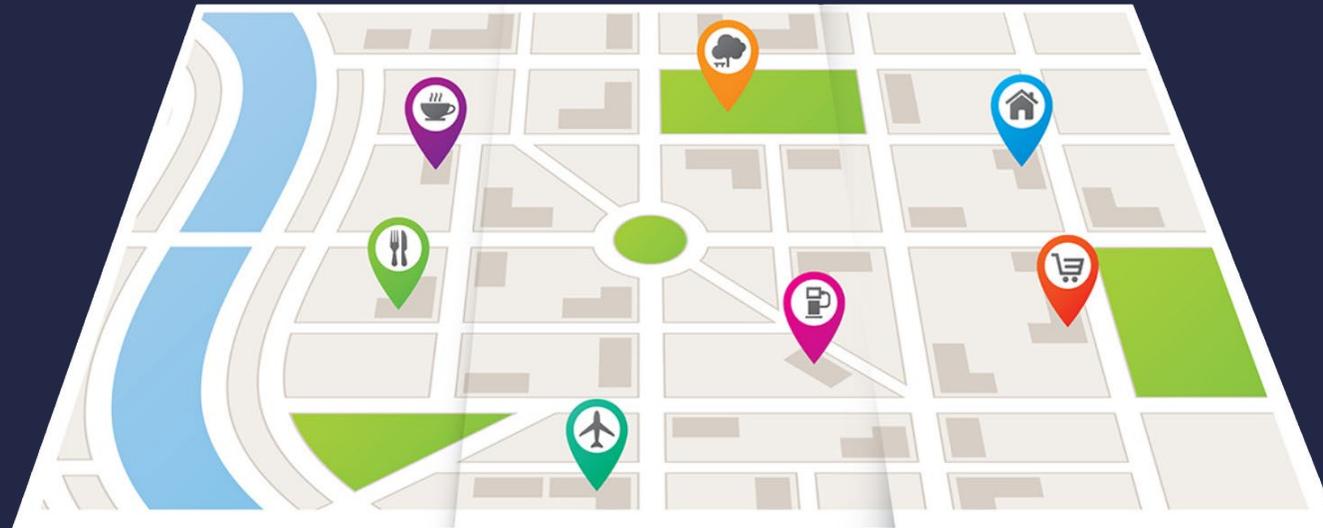
# GEOCODING

Sandeep Talasila, GISP



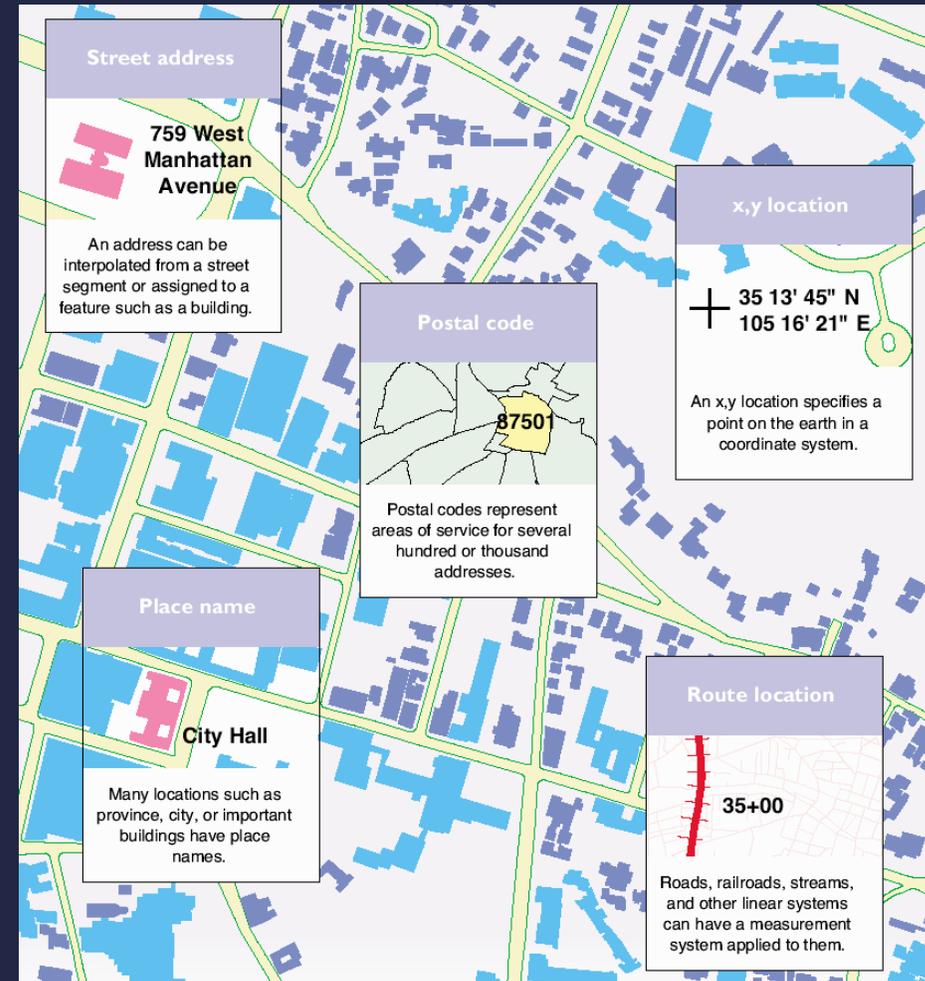
# GEOCODING

- *Geocoding is the process of transforming a description of a location – such as a pair of coordinates, an address, or a name of a place – to a location on the earth's surface. – ArcGIS*



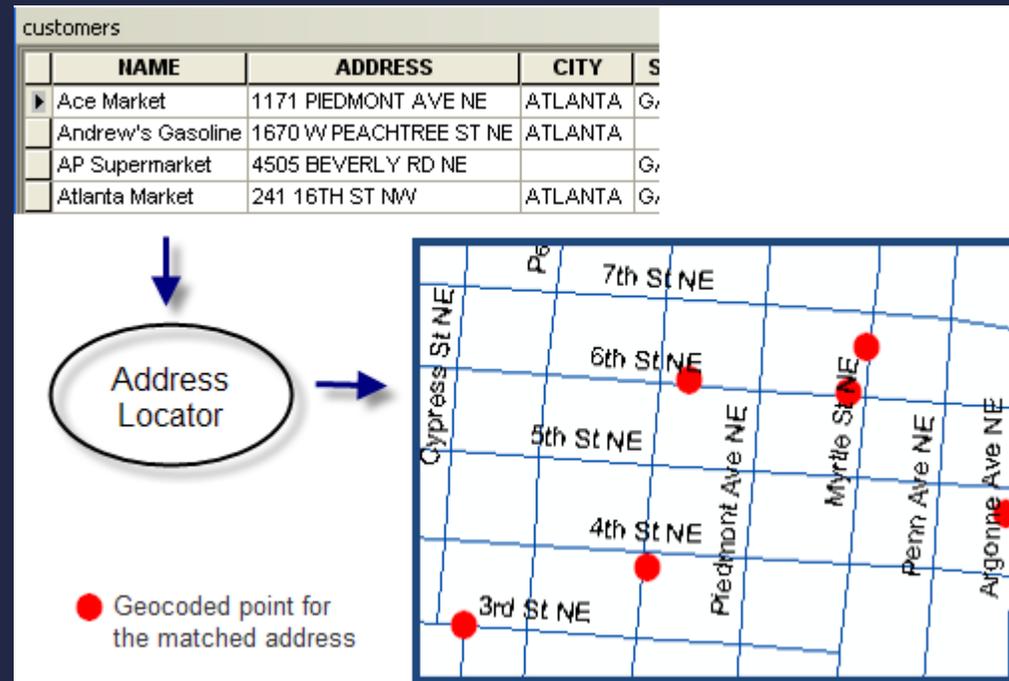
# TYPES OF LOCATIONS

- Coordinates (x, y)
- Street addresses
- Postal codes
- Place names
- Route location

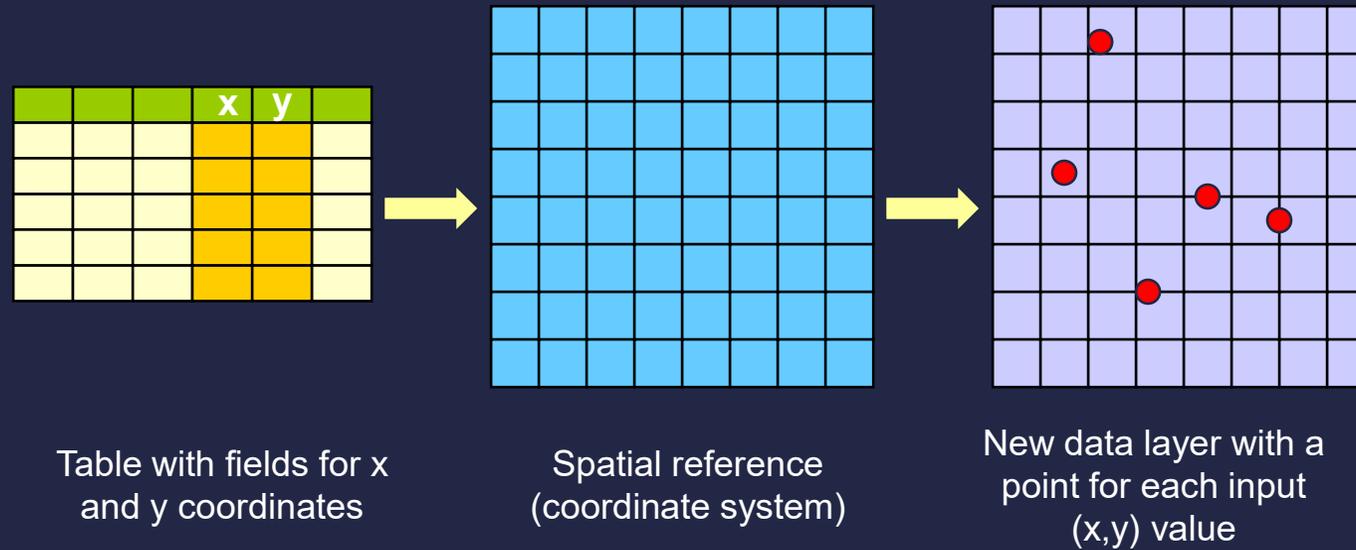


# COMPONENTS OF GEOCODING

- Location Data
- Reference Data
- Address Locator
- Results



# CONVERTING (X,Y) LOCATIONS



This is how we map GPS data!

# CONVERTING ADDRESSES

On a table with addresses, specify the address fields.

Address tables can contain addresses with either two or four address fields.

table with two address fields

table with addresses			
	18 Quirin Rd		43502
	221 Lena Dr		10010
	110 Michaela St		90210
	90 Francisusi Ave		34112

field with house number and street name

field with city, state, or postal code

table with four address fields

table with addresses				
	413 Benoy Blvd	Pasadena	CA	92373
	22 Lila Lane	Taos	NM	87501
	96 Chloe Court	Velarde	NM	87505

field with house number and street name

city field

state field

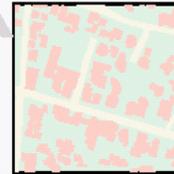
postal code

Select an address locator and set spelling sensitivity.

address location method  
if US postal addresses  
find segment containing address  
interpolate number against range  
even addresses go on one side  
odd addresses go on other side  
...



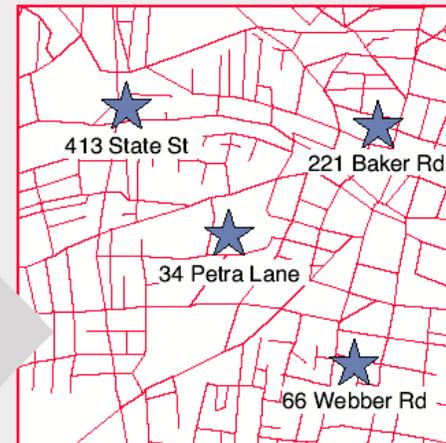
You can match addresses against a street network with address ranges or point or polygon data that has addresses as attributes.



Following the national postal conventions, positions are found for each address and points are created in a new feature class.

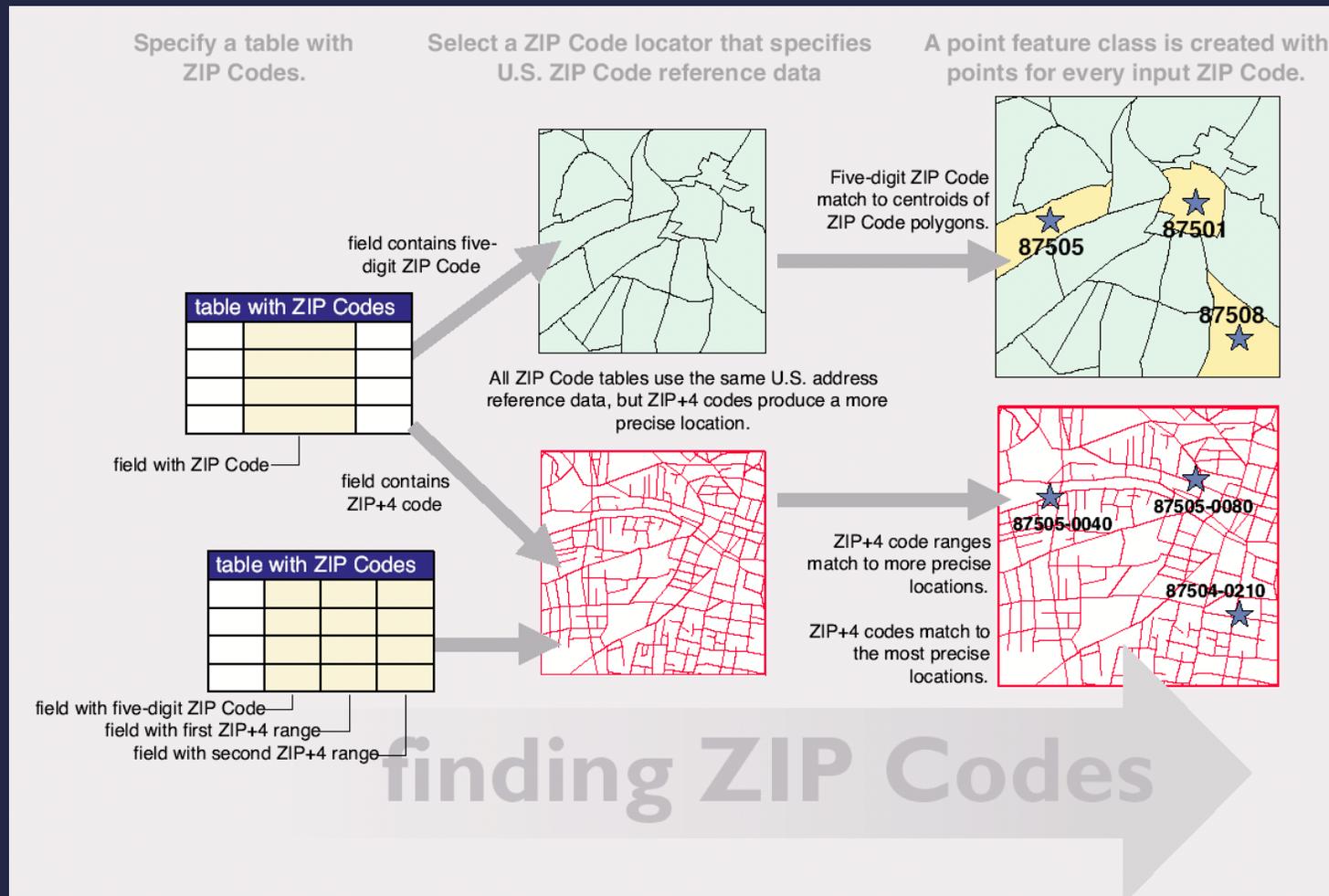
Standardized addresses are optionally written to a field.

Matching addresses can be ambiguous because of spelling errors and incomplete addresses. After you have processed an address table, you will find a percentage of point features for which no position was created. You can postprocess these missing addresses and correct them.



finding addresses

# CONVERTING ZIP CODES



# ADDRESS ELEMENTS

- Address (house or building) number
- Prefix direction
- Prefix type
- Street name
- Street type
- Suffix direction
- Zone
- Postal Code
- ...



# ADDRESS FORMATS

76 - 20 34th Ave, Jackson Heights, Queens, NY 11372

Cross street name | House number | Street name | Street type | City | Borough | State | Postal code

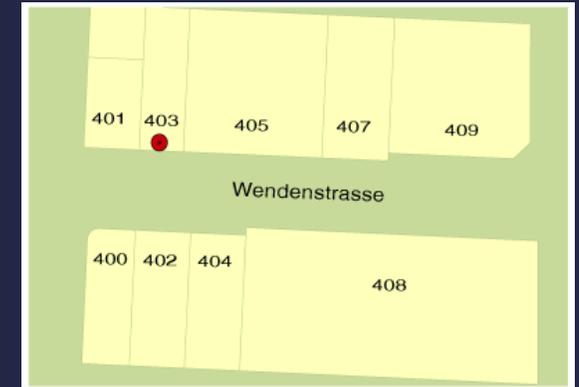
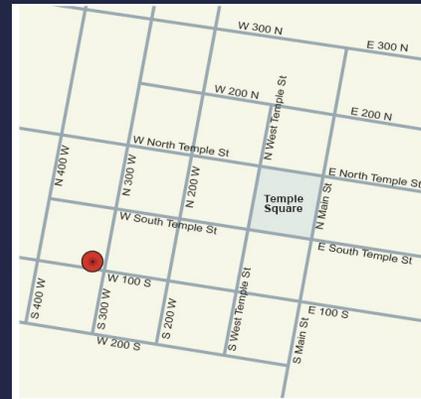


Wendenstrasse 403, 20537 Hamburg

Street name and Street type | House number | Postal code | City

305 W 100 S, Salt Lake City, UT 84119

House number | Prefix direction | Street name | Suffix direction | City | State | Postal code



# GECODING WORKFLOW

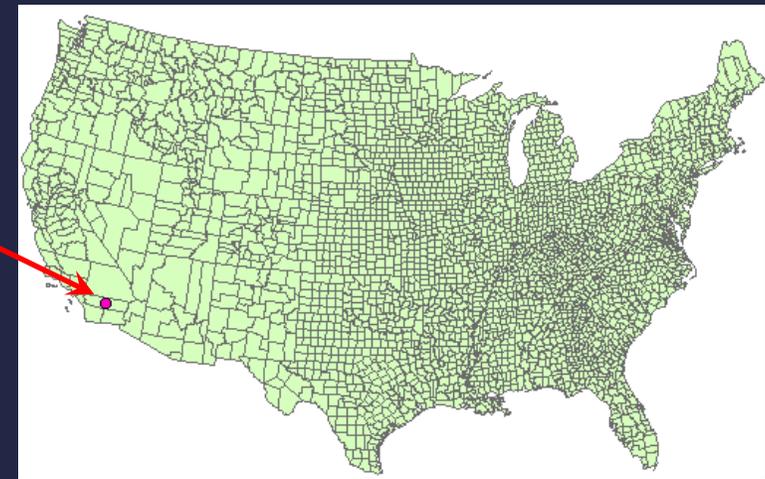
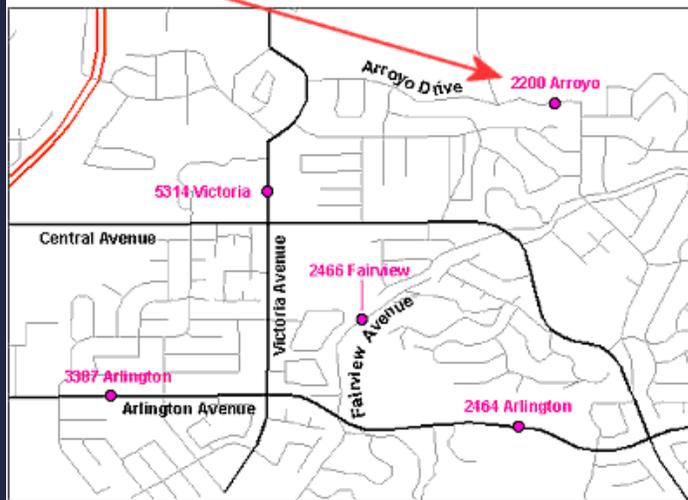
- Build or obtain reference data
- Determine address locator style
- Build an address locator
- Locate addresses
- Publish or maintain the address locator

# REFERENCE DATA

- Topologically Integrated Geographic Encoding and Referencing system (TIGER)
- Other Street data – Local entities or Commercial
- Parcels
- Zip code
- ...
- Note: address locator needs to rebuild once reference data are updated.

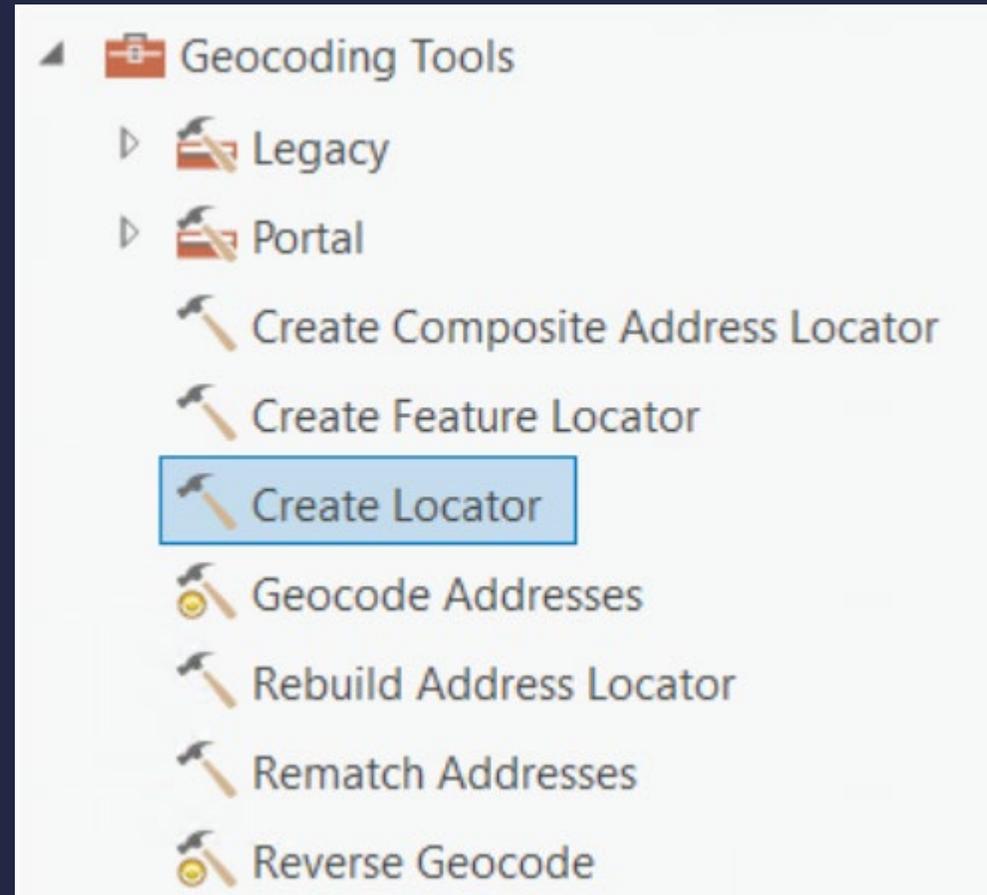
# USING STREET REFERENCE FILE

Address	City	State	Zip
3387 Arlington Avenue	Riverside	California	92506
5314 Victoria Avenue	Riverside	California	92506
2466 Fairview Avenue	Riverside	California	92506
2464 Arlington Avenue	Riverside	California	92506
2200 Arroyo Drive	Riverside	California	92506

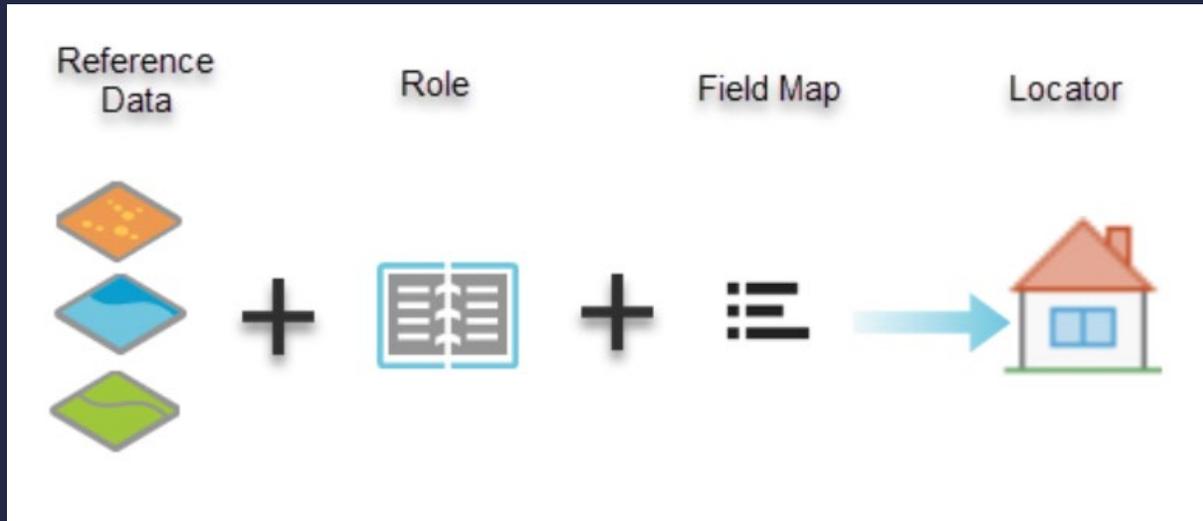


# ADDRESS LOCATOR

- It's an essential geocoding tool.
- It contains a snapshot of the reference data that is used for geocoding
- Address locator file is created with following extensions
  - \*.loc, \*.loz – stores reference information
- Can be shared as a Locator Package or as a Service



# CREATE ADDRESS LOCATOR



pro.arcgis.com

**Geoprocessing** ⌵ ⌵ ✕

⬅ **Create Locator** ⊕

Parameters Environments ?

Country or Region  
United States ⌵

\* Primary Table(s) Role  
 📁 ⌵

\* Field Mapping

Output Locator  
new\_locator 📁

\* Language Code  
 ⌵

⌵ **Optional parameters**

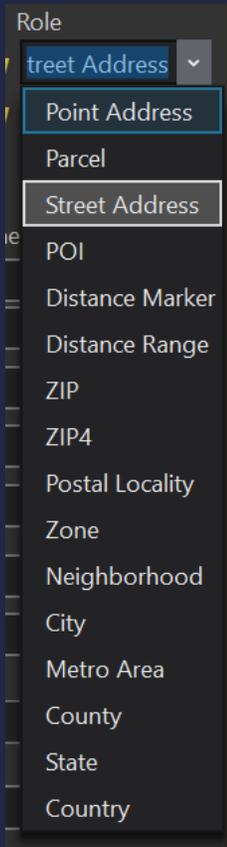
Alternate Name Tables Role  
 📁 ⌵

Alternate Data Field Mapping

Custom Output Fields

Precision Type  
Global High ⌵

# ADDRESS LOCATOR ROLES



Role	Typical reference dataset geometry	Typical reference dataset representation	Address search parameters	Examples	Applications
Point Address	Points or polygons	Each feature represents an address	Address elements in a single field	71 Cherry Ln	Finding parcels, buildings, or address points
Parcel	Points or polygons	Each feature represents a parcel	All address elements in a single field	320 Madison St. 1760820300	Finding parcels or address points
Street Address	Lines	Each feature has the address range for both sides of the street segment	All address elements in a single field	2 Summit Rd. N5200 County Rd PP 115-19 Post St.	Finding a house on a specific side of the street or street intersections
POI	Points or polygons	Each feature represents a particular geographic place name or landmark	All place name elements in a single field	Leeds Castle, England Sapporo, Japan	Finding geographic place names or landmarks in an area or the world
Distance Marker	Points or polygons	Each feature represents sequentially numbered markers placed along roads at regular intervals	Distance marker in a single field	Mile 25 I-25N, Raton, NM	Finding a distance marker sign on highway
Distance Range	Lines	Each feature represents the distance marker range for each line segment.	Distance marker range in a single field	Carr 682 KM 4.4, Barceloneta, 00617	Finding an approximate distance along a highway
Postal	Points or polygons	Each feature represents a single postal code region or centroid	Postal code in a single field	96822	Finding a specific postal code location
Postal Extension	Points	Each feature represents a single postal extension centroid	Five-digit ZIP Codes and four-digit extension in separate field	63703-0078	Finding a specific postal extension location
Postal Locality	Points or polygons	Each feature represents the union of postal code and city in a postal code boundary or centroid.	Postal code and city in a single field	7132 Frauenkirchen	Finding a specific locality
Administrative Areas	Points or polygons	Each feature represents a particular administrative area such as city, neighborhood, metro area, territory, region, and so on.	Administrative area name in a single field	British Columbia North Park, San Diego	Finding a specific administrative zone

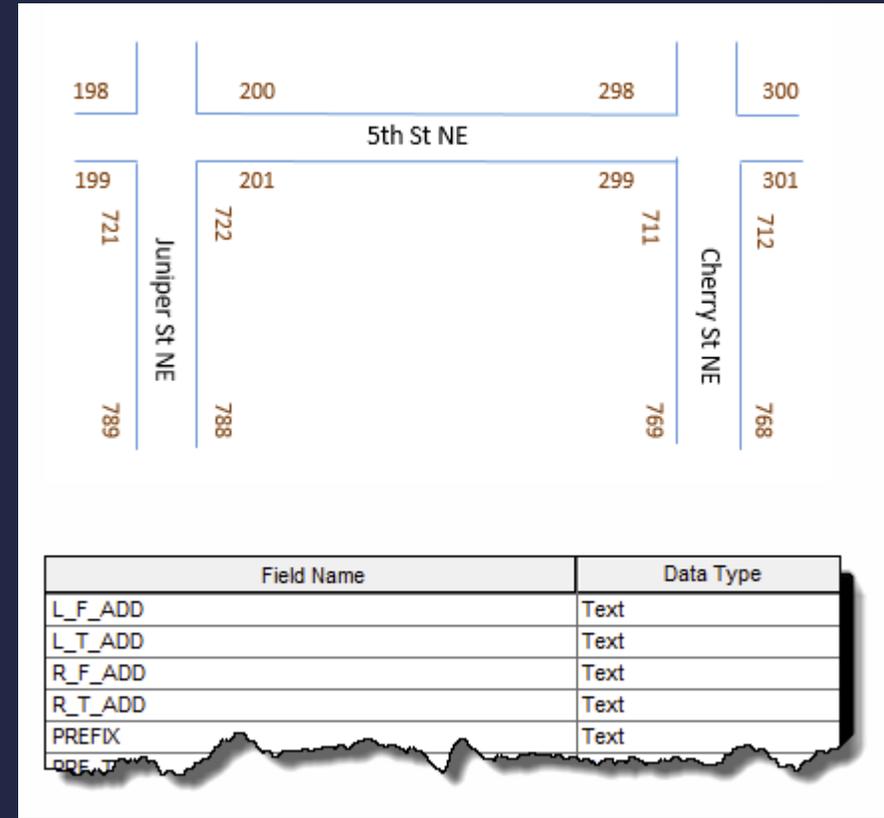
# POINT ADDRESS

- Reference data can be polygon or point geometry
- Each feature in the reference data corresponds to a single address such as a parcel or a building
- Data must have individual fields that contain a street number and street name information.



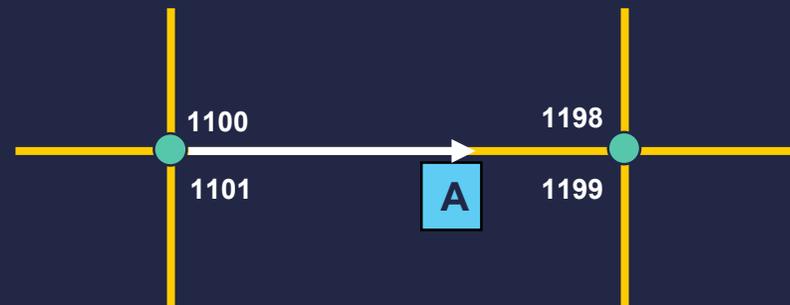
# STREET ADDRESS

- Reference data must contain dual ranges for roads
- Can provide a range of house number values
- Can determine side of the road segment the address is located
- Supports normal block ranges, alphanumeric addresses with grid zone, or hyphenated addresses containing cross-street information in the house number

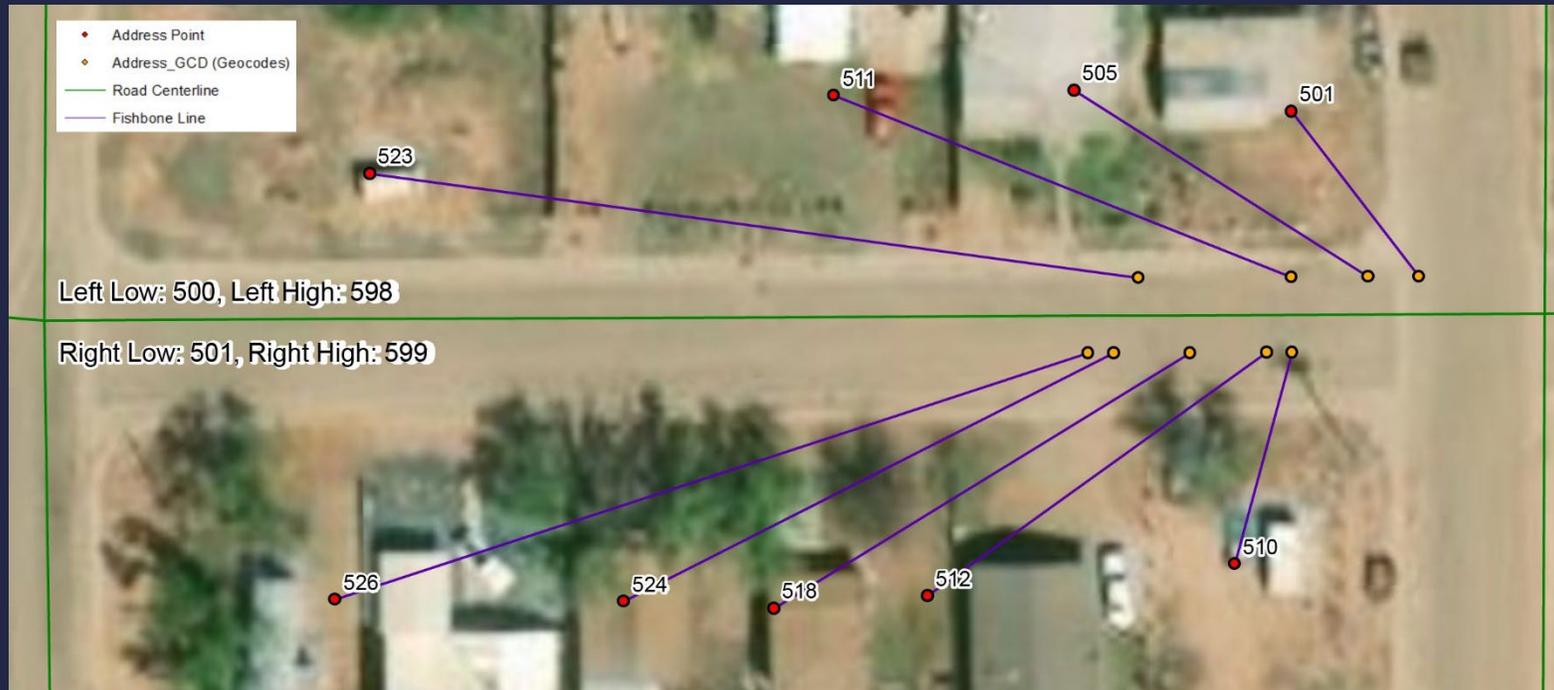


# REFERENCE DATA – ROADS

- A road network is represented by line segments
- Each intersection is represented by a node
- The coordinates of an address are interpolated linearly between the two nodes of a segment
- Example: 1167 Main St.

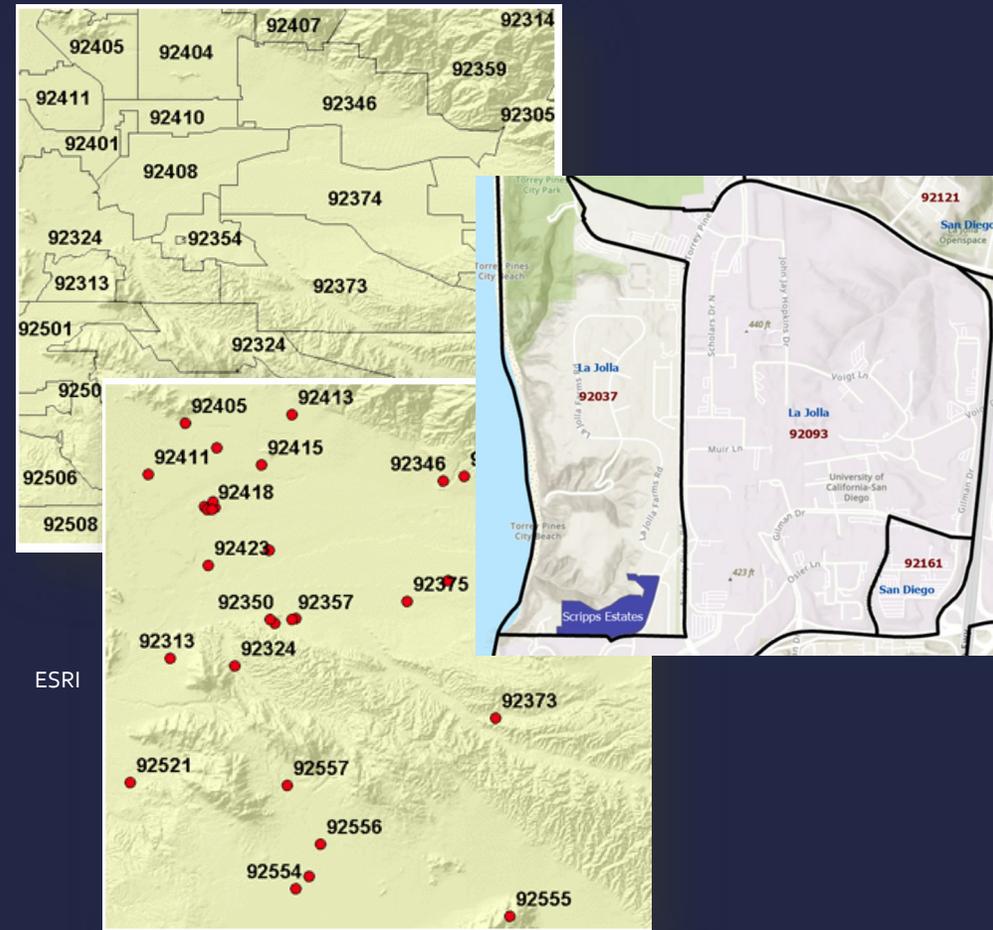


# ADDRESS INTERPOLATION



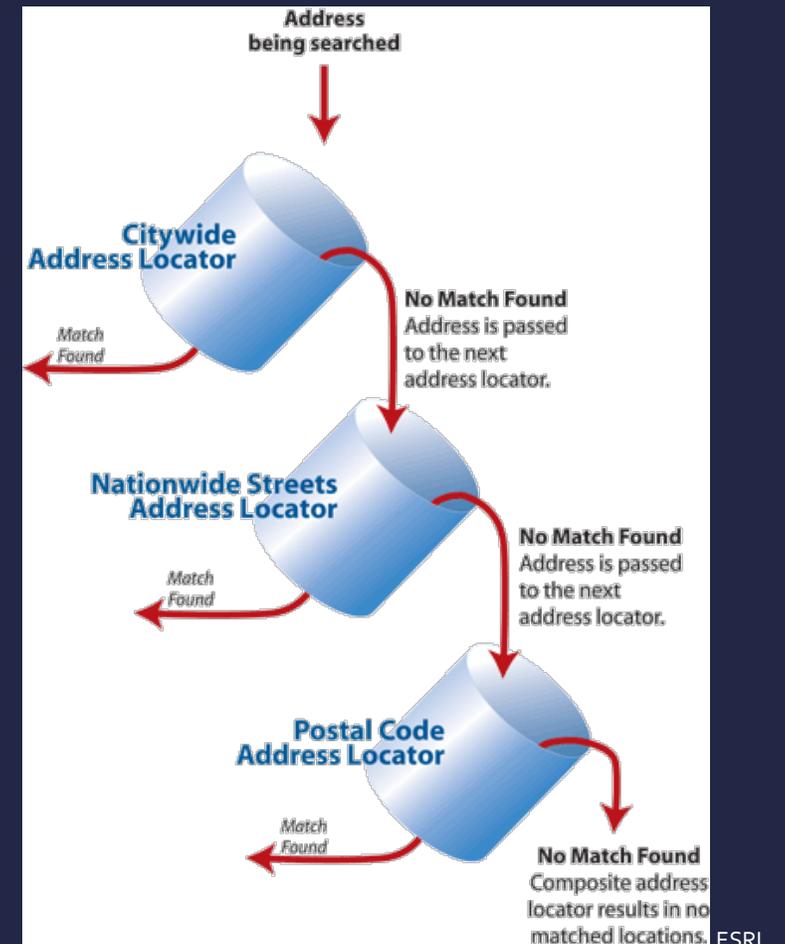
# POSTAL

- Reference data can be point or polygon geometry
- Each feature must contain a field that specifies the 5-digit postal code
- For polygon data the geocoded points will be at the centroid of the zip code polygon
- Postal Extension enables finding a specific postal extension location
- Postal locality enables finding a specific locality



# COMPOSITE ADDRESS LOCATORS

- Consists of two or more individual address locators
- Data are automatically matched against each of the individual locators
- Selection criteria can be set for the order of the locators

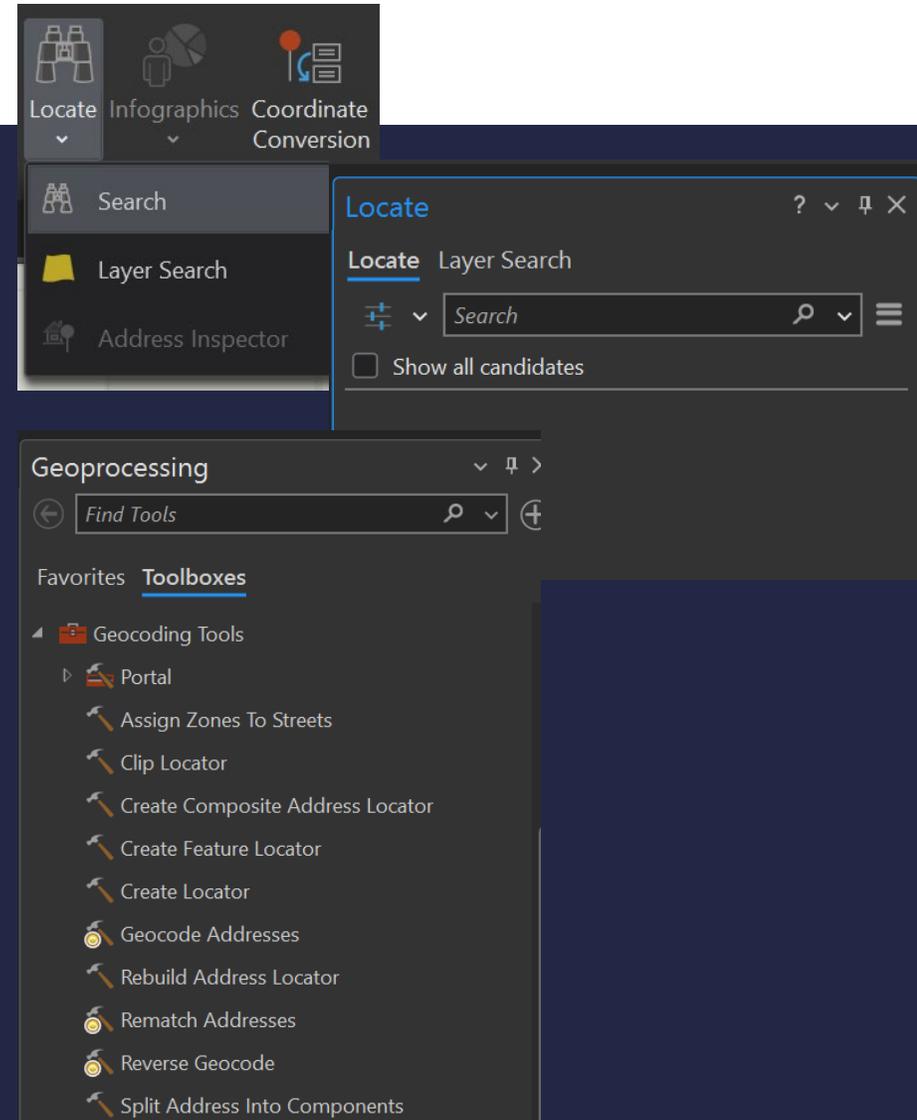


# MULTIROLE LOCATORS

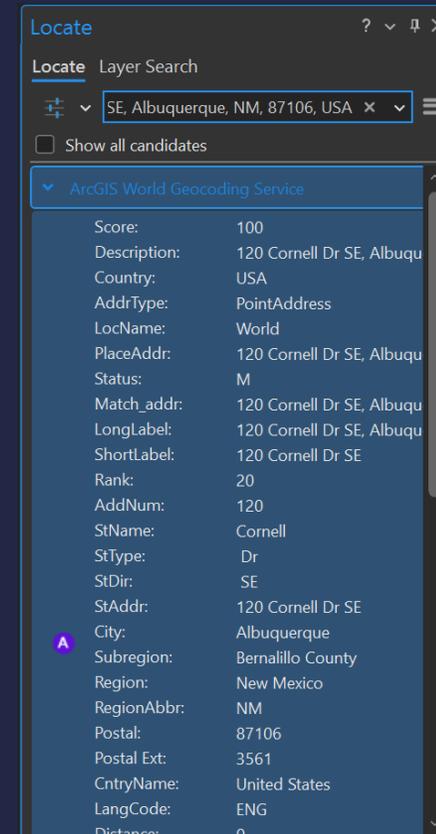
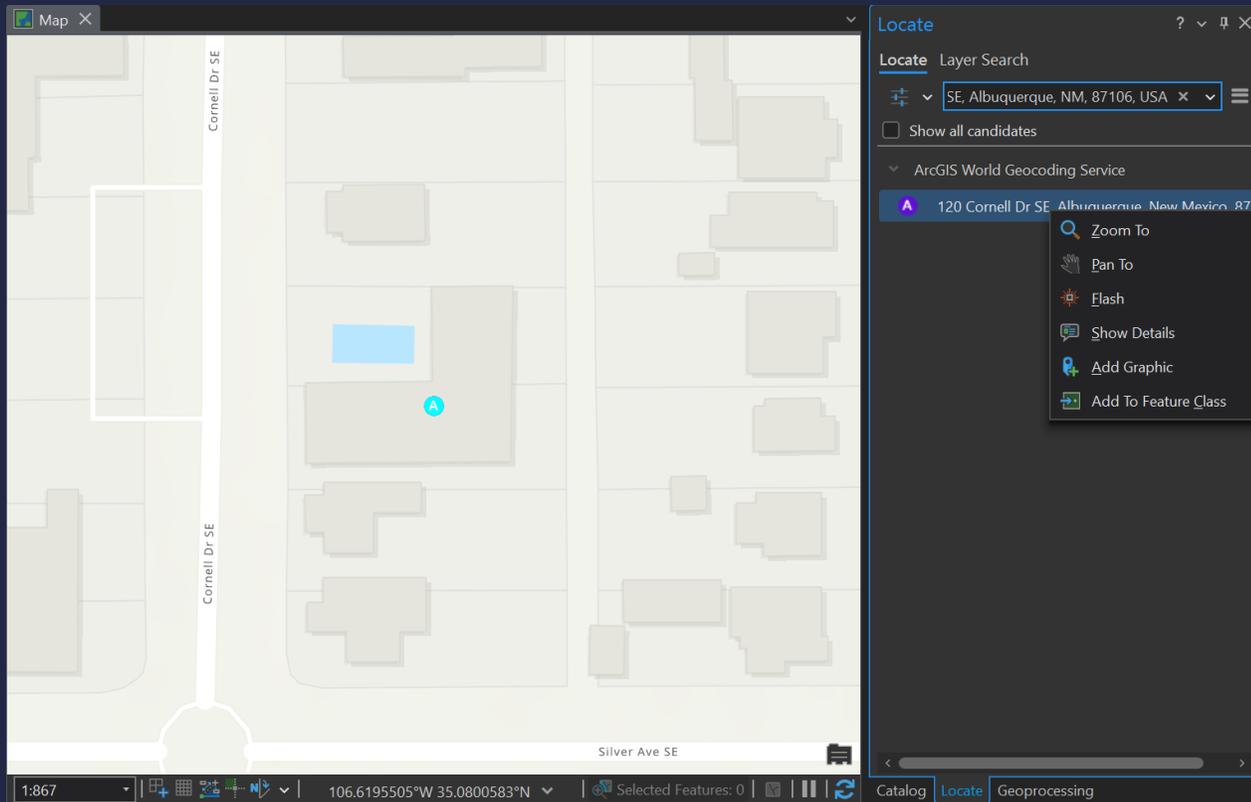
- Allows to combine multiple reference data layers and roles into a single locator to search for multiple types of locations at once
- Ex: rooftop locations, interpolated street locations, points of interest, etc.
- Reduces redundant information and candidates, beneficial for performance and reducing data size
- Minimize duplicate geocode results with multirole locators

# GEOCODING IN ARCGIS

- Create an Address Locator in ArcCatalog
- Locate Tool
- Geocoding Process
  - Add Address Locator to ArcMap
  - Select the Address Table to be geocoded
  - Save results as a feature class
  - Review results, including unmatched addresses
  - Decide on rematching strategy



# GEOCODING USING THE LOCATE TOOL



# GEOCODE ADDRESS TOOL

**Geoprocessing** [collapse] [pin] [close]

← **Geocode Addresses** [add]

Parameters Environments [help]

- \* **Input Table**  
[text box] [folder] [edit] [dropdown]
- \* **Input Address Locator**  
[dropdown] [folder]
- \* **Input Address Fields** Multiple Field [dropdown]  
Field Name Alias Name  
[text box] [dropdown]
- \* **Output Feature Class**  
[text box] [folder]

ADDRESS	CITY	STATE	ZIP
1171 PIEDMONT AVE NE	ATLANTA	GA	30309
1670 W PEACHTREE ST NE	ATLANTA		30309
4505 BEVERLY RD NE		GA	30309

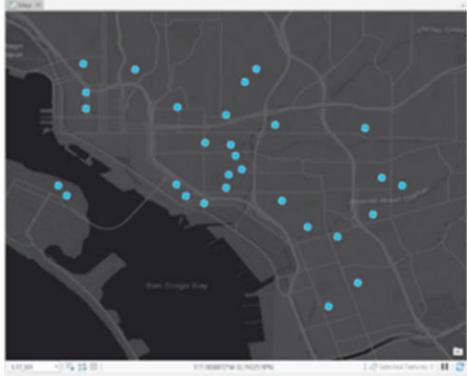
  

241 16TH	School	Full Address
1233 PEACHTREE ST NE	Albion Street Elementary School	322 S. Avenue 18, Los Angeles, California, 90031
360 FORTUNE DR	Alexander Science School	3737 S. Figueroa, Los Angeles, California, 90007
	Alexandria Ave Elementary School	4211 Oakwood Av, Los Angeles, California, 90004
	All Saints School	3420 Portola Av, Los Angeles, California, 90032

Allesan	ADDRESS	ADDRESS2	ADDRESS3	CITY	STATE	POSTAL_CODE
Alta Lor	2850	Oak Creek Dr	#B	Ontario	California	91761
	10336	Wateridge Cir	#300	San Diego	California	92121
	10336	Wateridge Cir	#296	San Diego	California	92121
	10336	Wateridge Cir	#298	San Diego	California	92121

↓



# OUTPUT DATA

- In addition to the user provided data, following are a few columns that are created by the software based on the locator style...
- **Status**—A code indicating whether the address was matched. Possible values include the following:
  - **M**—Matched. **U**—Unmatched. **T**—Tied (more than one match but different locations).
- **Score**—The match score of the candidate to which the address was matched. The score can be in a range of 0 to 100, where 100 indicates that the candidate is a perfect match.
- **Match\_type**—A code showing how an address was matched. You can group the results based on this attribute to show how the addresses were matched or use the grouping to select records for rematching. The codes are as follows:
  - **A**—Automatically matched or rematched.
  - **M**—Manually matched or unmatched.
  - **PP**—Pick by Point. The address was matched to the click point using the **Pick Address from Map** tool in the **Interactive Rematch** dialog box in ArcMap.
- **Match\_addr**—The address where the matched location actually resides based on the information of the matched candidate. For example, an input address of 123 Main St N is matched to a candidate with the suffix direction NW and all other components matched correctly. The **Match\_addr** field will contain 123 Main St NW as the actual address that was matched.
- **Addr\_type**—The type of address that was geocoded. This attribute indicates to what kind of feature the address was matched. You can study the accuracy of the matched addresses and pattern of the matches based on the values.
  - PointAddress, StreetAddress, Parcel,...

# ADDRESS LOCATOR PROPERTIES

Locator Properties: AddrLocator.loc

- About the locator
- Reference Data Tables
- Alternate Name Tables
- Input fields
- Output fields
- Geocoding options**
- Performance

**Match Options**

Match out of range

Minimum match score

Minimum candidate score

Intersection connectors

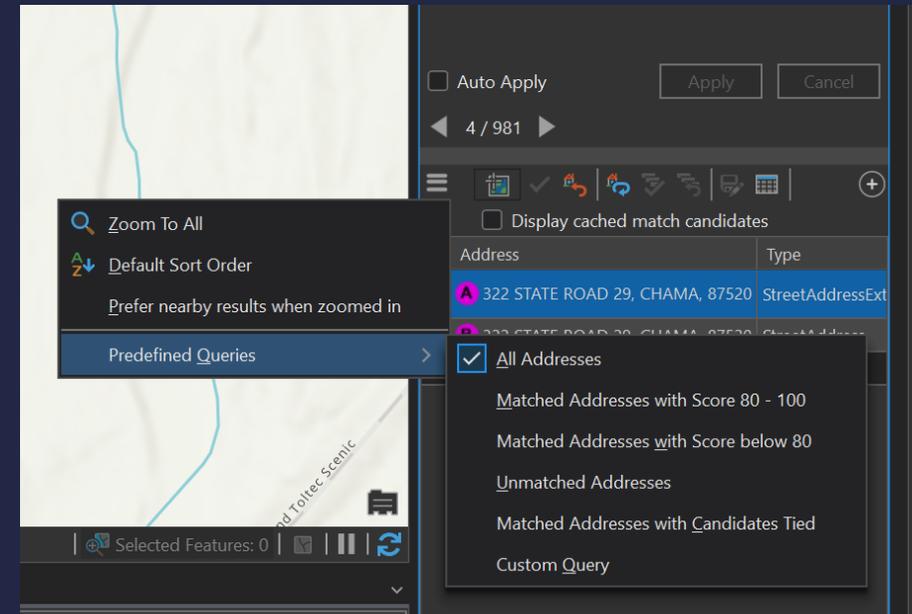
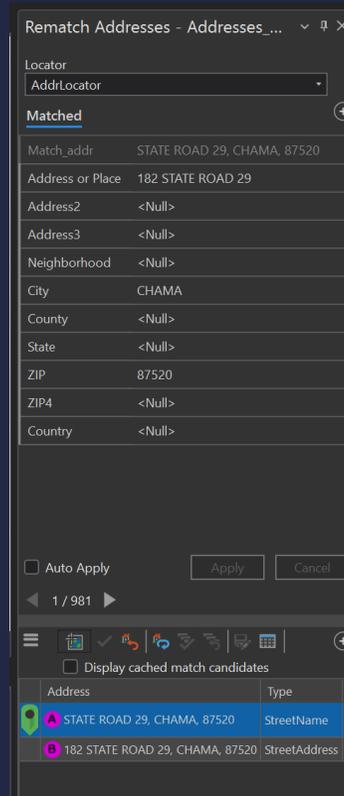
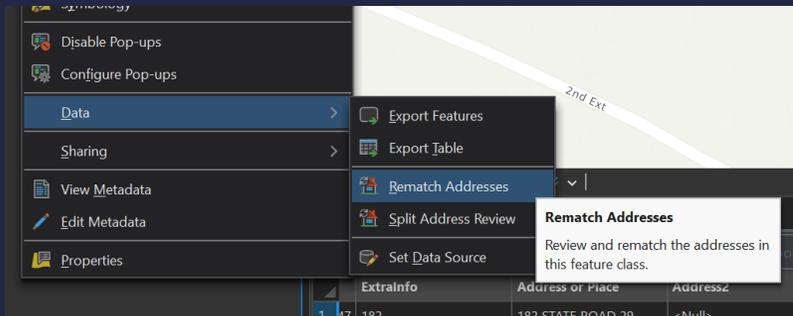
Match with no zones

Categories to support

- All categories supported by the locator
- Only categories selected here
- Only categories selected here None

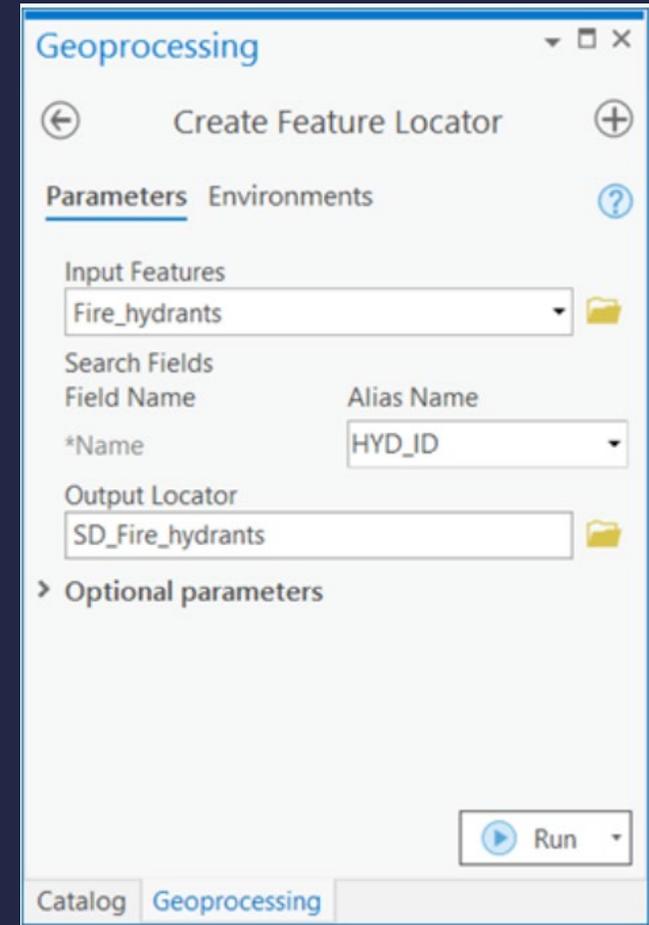
Modify parameters

# REMATCH PROCESS



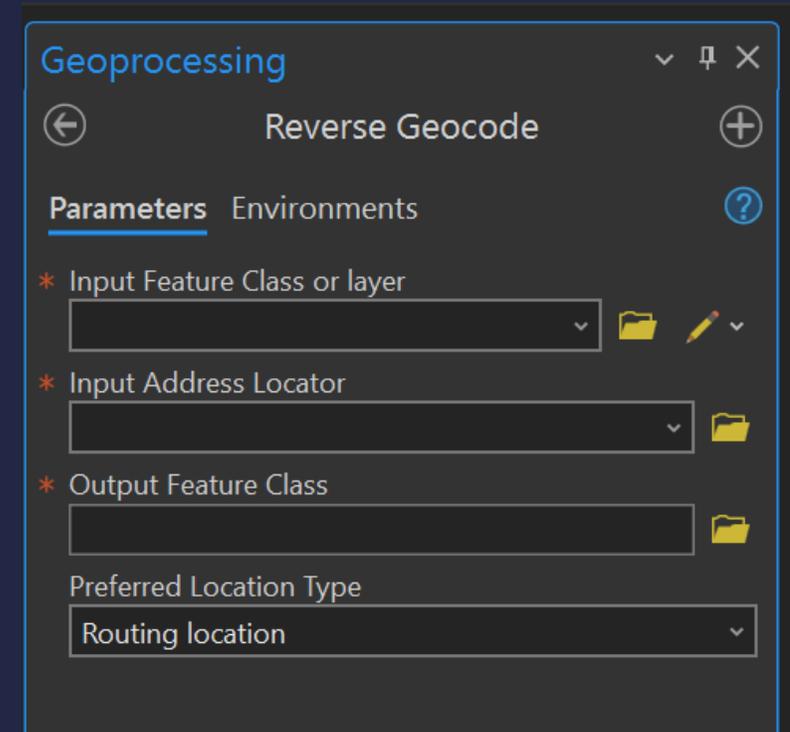
# CUSTOM DATA SEARCH – FEATURE LOCATOR

- Feature Locator – Search by features
  - Water meters, cell towers, oil wells, etc.

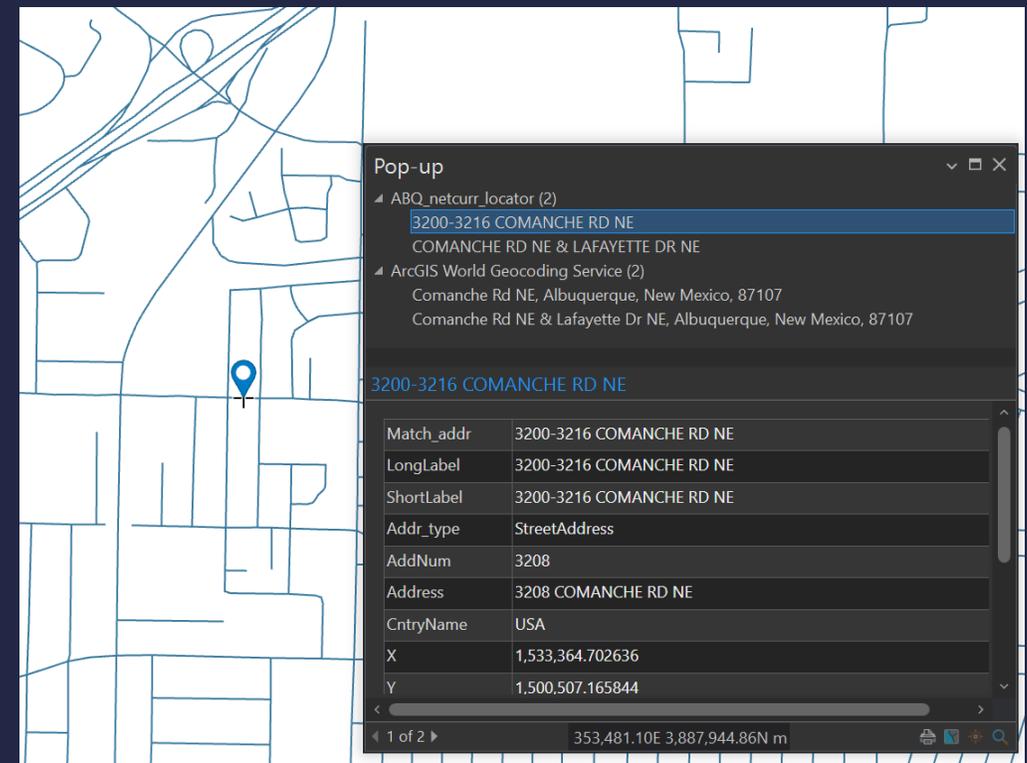
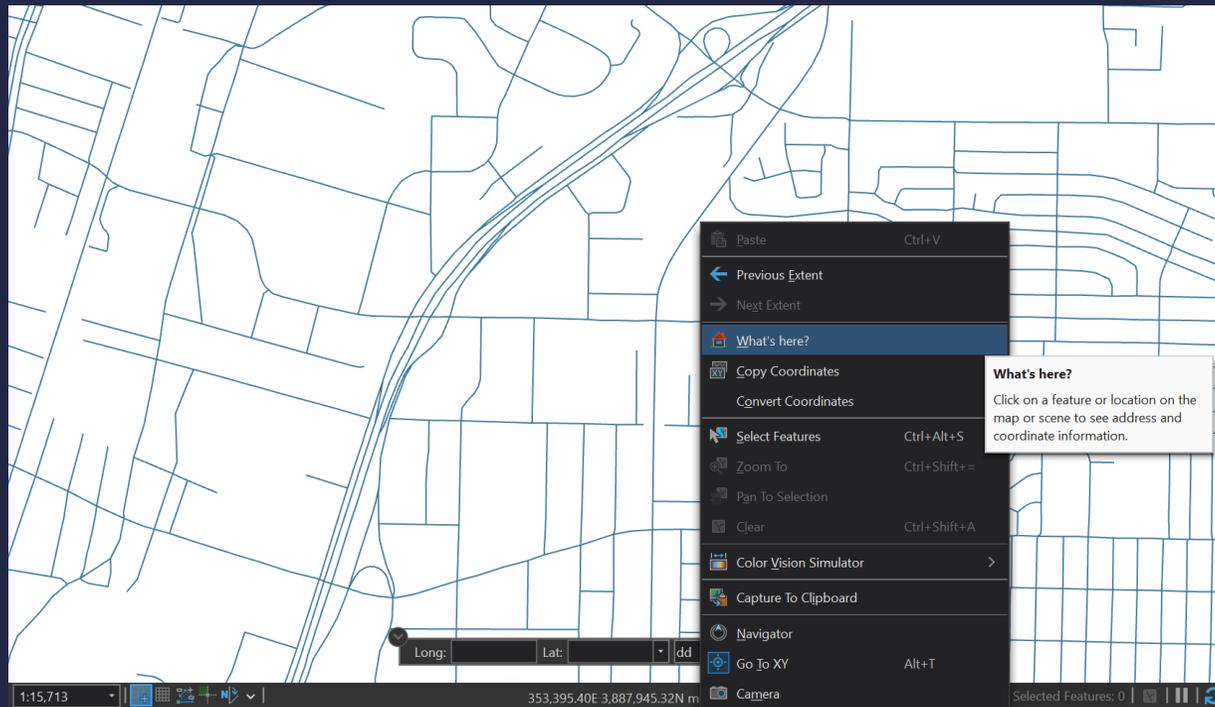


# REVERSE GEOCODING

- Searches for the nearest address, place, or intersection for the point location
- Input feature class must contain point shapes with valid coordinates



# REVERSE GEOCODING



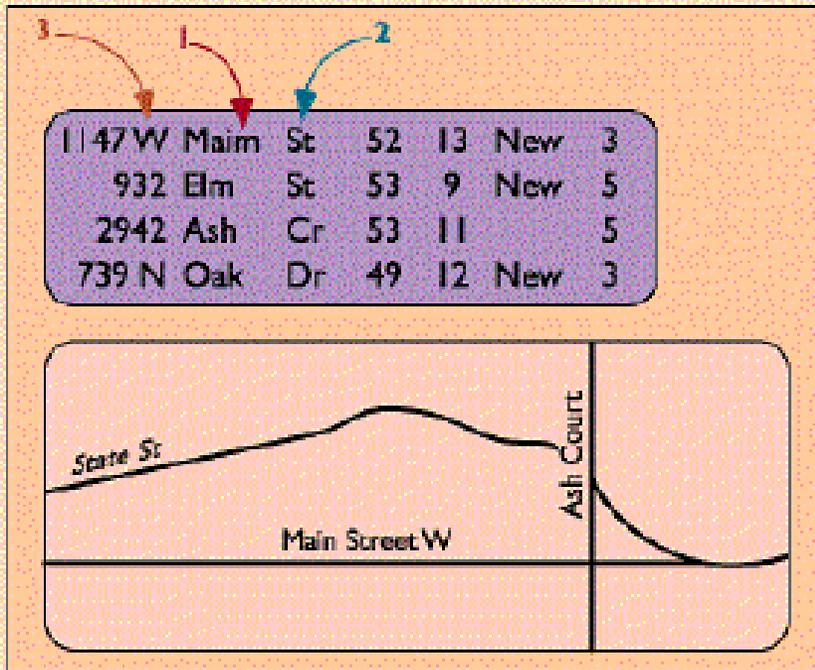
# GEOCODING PROBLEMS

- Address-matching is rarely a fully automated process.
- An address may not address-match because of inaccuracies or inconsistencies in the digital street map or in the file of addresses to be matched.
- Address-matching rates (the proportion of addresses that are correctly matched) will increase if efforts are made to increase the quality of the digital street map, the address file, or both.

# PROBLEMS – CONTINUED

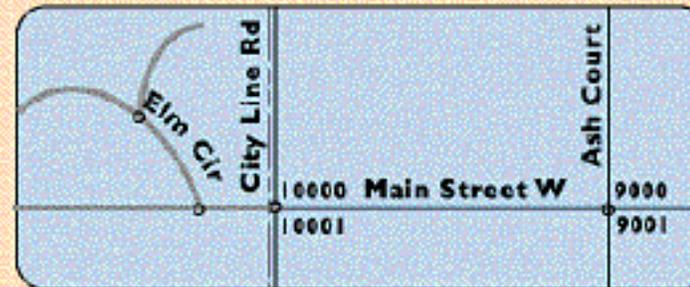
## Inconsistencies between Digital Map and Address List

1. Spelling & typographical errors (Maim St)
2. Abbreviation inconsistencies (St, St., Str, Street)
3. Prefix and suffix placement (W Main St, Main St W)

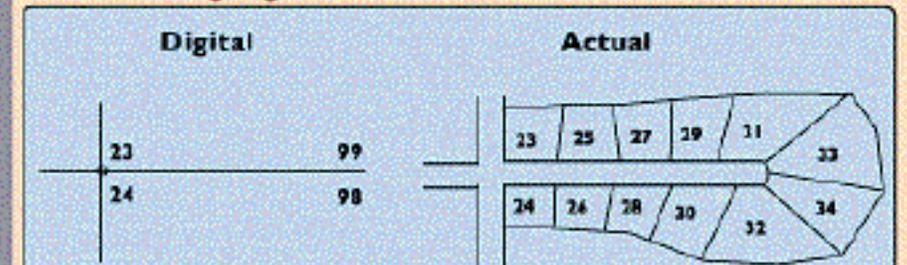


## Problems with Digital Map Attributes

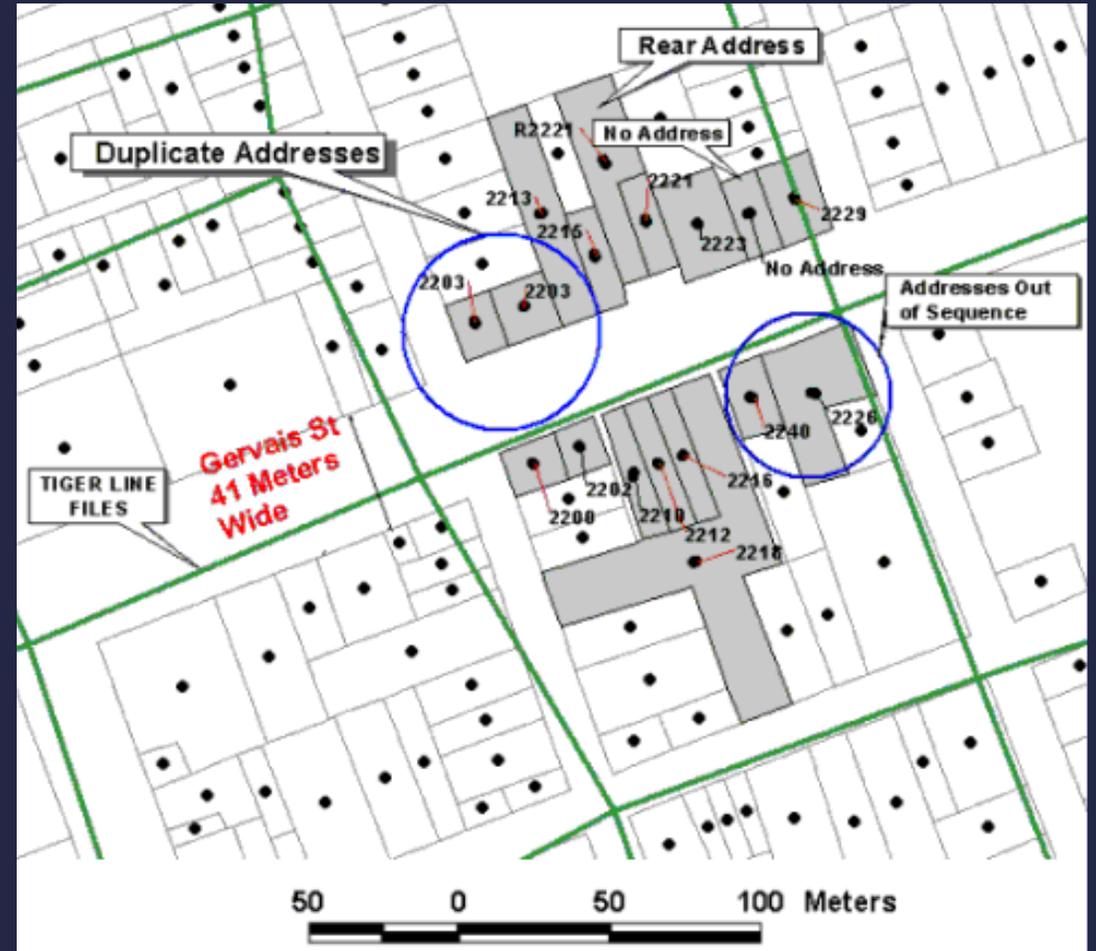
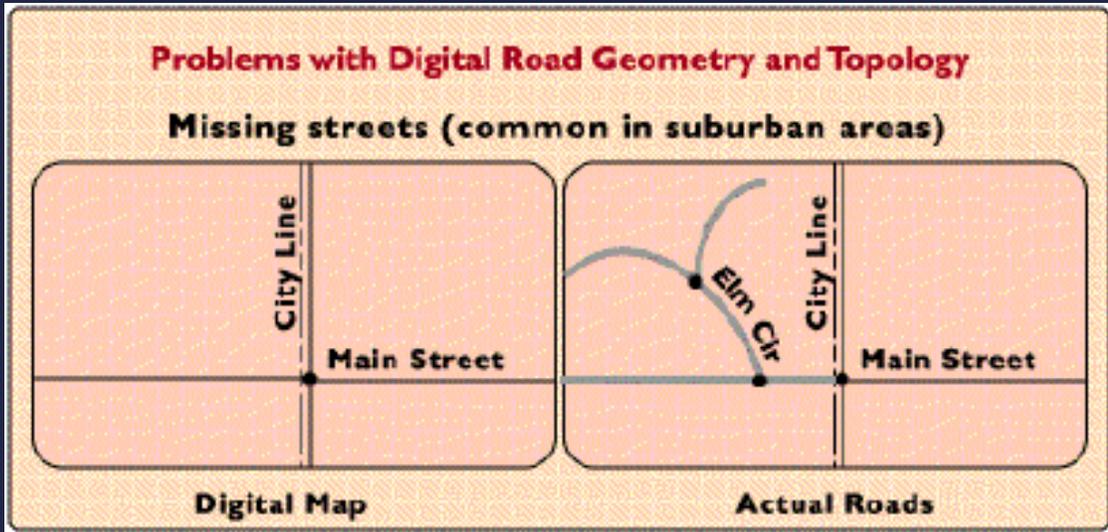
Missing address ranges (common in rural areas):



Incorrect ranges given for this street:



# PROBLEMS – CONTINUED



# PRACTICE

- Geocode a table of addresses
  - <https://pro.arcgis.com/en/pro-app/latest/help/data/geocoding/tutorial-geocode-a-table-of-addresses.htm>
- Rematch addresses from a geocoded feature class
  - <https://pro.arcgis.com/en/pro-app/latest/help/data/geocoding/tutorial-rematch-addresses-from-a-geocoded-feature-class.htm>
- Create a Locator
  - <https://pro.arcgis.com/en/pro-app/latest/help/data/geocoding/tutorial-create-a-locator.htm>