GEOCODING:
The Indiana Composite Locator
Geocoding is the process of transforming a description — such as a pair of coordinates, an address, or a name of a place—to a location on the earth's surface. (ESRI)
What is a ESRI Locator?

A locator is a customized ESRI tool that has been built using location data (any ESRI user can do this!)

- Built using point or street data
- Reference data should be standardized and have a coordinate system/projection
- Many locator styles are available
A composite locator is made up of multiple locators, each referencing a unique dataset and matching to different location types. Cascading order is important. Locators are searched from the top down. All locators within the composite should have the same coordinate system and projection.
The Indiana State Composite Locator is a collaborative effort by the Indiana Geographic Information Office, ISDH, IDEM, DNR, INDOT, IPSC, Indiana Geographic Information Council (IGIC), and local governments. Many people are involved in the collection, pre-processing, and standardization of reference data required to create the final geocoder product.
The Indiana Composite Locator is published as a REST service which can be interacted with from a variety of platforms.

- **ArcMap**
  - Requires ESRI License
- **ArcGIS Online**
- **REST Service**
  - Does Not Require ESRI License
  - **GHC Web Geocoding Application**
  - **Excel**
  - **R**

**NOTE** Indiana Composite Locator is the default locator for State Enterprise AGOL Accounts.
ArcMap Example
Adding Address Data

Addresses may be stored in any common table format: .xls, .xlsx, .dbf, .txt, .csv, .mdb, or Oracle table

<table>
<thead>
<tr>
<th>Multi-Field Input</th>
<th>Single Field Input</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Table with columns: ADDRESS_STREET1, ADDRESS_STREET2, ADDRESS_CITY, STATE, ZIP_CODE, COUNTRY" /></td>
<td><img src="image" alt="Table with columns: SingleLineAddress" /></td>
</tr>
</tbody>
</table>

OR

- 5250 E USHY 36, AVON, IN 46123
- 112 HOSPITAL LN, DANVILLE, IN 46122
- 7 MANOR DR, DANVILLE, IN 46122
- 1000 E MAIN ST, DANVILLE, IN 46122
- 8244 E US HIGHWAY 36, AVON, IN 46123
- 321 E NORTHFIELD DR, BROWNSBURG, IN
ArcMap Example
Adding the Geocoding Toolbar

Customize → Toolbars → Geocoding
• Manage address locators
• Search and view single address
• Inspect addresses
• Geocode address table
• Rematch addresses
ArcMap Example
Adding the State Composite Locator

From the Geocoding Toolbar:
• Choose Manage address locators
• Navigate to GIS Servers
• Add State ArcGIS Server
• URL: https://gis.in.gov/arcgis/services
• Locate Indiana_Composite_Locator
ArcMap Example
Start Geocoding!

Many ways to get started
1. Right-click on address table in Table of Contents
   OR
2. Select Geocode tool from Geocoding Toolbar
   OR
3. Choose Geocoding Tools > Geocode Addresses from ArcToolbox
- Select the address table
- Choose Address Input Fields
- Defaults parameters will be set...they can be changed
- Advanced Geometry: Sets projection
- Geocoding Options:
  - Offsets set at 0
  - Check (✓) X and Y coordinates
  - Check (✓) Reference data ID if needed
  - Composite: Parameters set for each locator
  - Match ties only needed for street segments

Geocoded feature class will have points only for matches and ties

Some records will not have corresponding points because of errors in the data
Geocoding Example
Check Results

Unmatched addresses can be matched manually

Geocoding Addresses...

- Matched: 9427 (72%)
- Tied: 0 (0%)
- Unmatched: 3585 (28%)

Completed
Average speed: 711,000 records/hour

Match the Addresses
Adjust geocoding parameters

Some records may not be matched due to data entry errors !!!
Identifying and Reducing Errors

- Spelling errors are a common reason for an unmatched address.
- Other sources of error might include:
  - Incorrect prefixes or suffixes
  - Incorrect house numbers
  - Incorrect ZIP Codes
  - Extra blank spaces - either between words or at the beginning or the end of the address field.
- Use of the wrong zipcode can lead to incorrect point location because zip is considered first when locating street address.
Geocoding Results
Challenging Addresses

Identifying Mismatches:

• Missing reference data

• Outdated reference data

• County and state road names are frequently difficult due to multiple ways of referencing these features

• A less accurate locator (ZCTA, TIGER) may have a higher score than a match from a more accurate locator (IDSI) within the composite.

• Inclusion of Unit in a single line address may cause mismatches - Standardization of addresses before geocoding can reduce some of these errors.
Geocoding Results
Match Rates by Zip

Address Geocode Rates By Zip Code

% Matched to Address
- 0
- 60
- 70
- 80
- 90
- 100

Map Author: ISDH ERC PhD, 07.07.14

Indiana Address Geocode Rate: 94%
The composite geocoder created in ArcGIS Desktop is published to a REST Service hosted by the Indiana Geographic Information Office and is available for public use.

- Representational State Transfer (REST) – a web service that can be queried using Hypertext Transfer Protocol - Uniform Resource Locator (HTTP URL)
- Query Results in Open Data formats (HTML, JSON, KMZ) and any coordinate system/projection. GeoJSON output will be available in the future.
- Currently returns up to 1,000 records.
- Example:
  https://gis.in.gov/arcgis/rest/services/Indiana_Composite_Locator/GeocodeServer/geocodeAddresses?addresses=[{"records": [{"attributes":{"OBJECTID": 1, "Address": "2 North Meridian, Indianapolis, IN 46204"}}]}]&outSR=WKID+%3D+4326&f=html
- Example with encoding:
  https://gis.in.gov/arcgis/rest/services/Indiana_Composite_Locator/GeocodeServer/geocodeAddresses?addresses=%7B%22addresses%22%3A%5B%22%7B%22attributes%22%3A%7B%22OBJECTID%22%3A1%2C+%22Address%22%3A+%222+North+Meridian%2C+Indianapolis%2C+IN+46204%22%7D%5D%7D%22%7D%22%7D&outSR=WKID+%3D+4326&f=html
REST Service Documentation

Indiana Open Geocoder Service

What is it?
The Indiana Geocoder is a geographic coding web service for finding a location (x,y) based on a given address, city, zip code, county or PLSS Township-Range Section.

How is it created?
The service is a product of the Indiana GIS Data Sharing Initiative. Address locations and parcels are harvested from local government information systems and merged into a single “rooftop” state-wide dataset. Additional datasets collected from various sources are also included in the service to provide a robust geocoding solution.

Who can use it?
Anyone can use the service!

Use Limitations
This service, including its underlying data and results, is distributed “AS-IS” without warranties of any kind, either expressed or implied, including but not limited to warranties of suitability of a particular purpose or use. These data graphical representations and are for reference purposes only. They are not to be construed as a legal document or survey instrument. A detailed on-the-ground survey and historical analysis of individual features may differ from this data.

Credits
Indiana Geographic Information Office, Indiana Geographic Information Council, Indiana Department of Homeland Security, Indiana State Department of Health, Indiana Department of Natural Resources, Indiana Department of Transportation, and all local governments in Indiana.

Update Schedule
Next Update: Not yet scheduled
- Adding Census Block id to "User_fld" results
- Considering standardization of addresses in addition to address provided through local gov
- Request additional features - send email to health@igic.org

Last Update: May 16, 2016
- Added the ability to geocode to locations in adjacent states (IL, KY, MI, OH) using 2015 Census TIGER data. To accomplish this, a new locator was added to the composite service. “TIGER_OOS” is now included in the domain of values returned in the “Loc_name” field.
- Added the ability to retrieve the county name and county fips of the geocoded location. The county values appear in the “User_fld” field. The “User_fld” contains a semi-colon delimited to distinguish between values.

Links for Developers
- Indiana Geocoder (production) - URL to the REST Geocoding Service
- Indiana Geocoder (test) - URL to the test service
- Geocoder using JavaScript (no additional framework or api required)
- REST API documentation (coming soon)
- ESRI JavaScript API documentation (coming soon)
- OpenLayers Javascript API documentation (coming soon)

Links for Users
- Starter Map - Paste addresses, geocode and map. Download results to csv. It’s that easy!
- Geocode from Excel (example coming soon)
- Geocode from R
- Geocode from SAS
- Geocode from Excel (example coming soon)
- Geocode from QGIS (example coming soon)
- Download the Locator file (coming soon)

Attention All Users of the Geocoder!
You should always review the LOC_NAME field in the geocoding results to determine spatial accuracy. See Service Description below.

Are your Indiana addresses being matched to streets outside of Indiana? If so, ensure you include a "State" field populated with "IN".

How has this geocoder benefited you? Have you found errors or received unexpected results? Do you have suggestions to improve the geocoder? Do you want to be alerted to geocoder updates? Send email to health@igic.org.

Link to the Geocoding Service:
https://gis.in.gov/arcgis/rest/services/Indiana_Composite_Locator/GeocodeServer

Documentation and Examples can be found here:
https://gis.in.gov/apps/isdh/geocode
REST Service Example: Find Candidates

https://gis.in.gov/arcgis/rest/services/Indiana_Composite_Locator/GeocodeServer

Find Address Candidates: (Indiana_Composite_Locator)

- **Street:**
- **City:**
- **State:**
- **ZIP:**
- **Country:**
- **SingleLine:**
  - 2 North Meridian, Indianapolis
- **Out Fields:**
- **Max Locations:**
- **Output Spatial Reference:**
- **Search Extent:**
- **Format:** JSON

Find Address Candidates (GET) Find Address Candidates (POST)

Output results as HTML, JSON, or KMZ
REST Service Example

https://gis.in.gov/arcgis/rest/services/Indiana_Composite_Locator/GeocodeServer

ArcGIS REST Services Directory

Home > services > Indiana_Composite_Locator (GeocodeServer) > geocodeAddresses

Geocode Addresses: (Indiana_Composite_Locator)

Addresses:

```
[{
  "records": [
    {
      "attributes": {
        "OBJECTID": 1,
        "Address": "2 North Meridian, Indianapolis, IN 46204"
      }
    },
    {
      "attributes": {
        "OBJECTID": 2,
        "Address": "100 N Senate Ave, Indianapolis, IN 46204"
      }
    }
  
```

Output Spatial Reference: 

Format: JSON

Geocode Addresses (GET)  Geocode Addresses (POST)
ArcGIS Online Example
Finding A Single Address
A CSV list of addresses (single line or standardized) can be added to an ArcGIS Online Map and geocoded using the Default Geocoding Service.

For Indiana State Enterprise Agreement Members, the default locator is the State Composite Locator.

For non-Enterprise accounts, the default locator is ESRI's World Geocoding Service.

**ArcGIS Online Example**

**Geocode A List of Addresses**

Result features can be saved to your content and shared/exported. But, the result does not include lat/long, user field, or locator type.
# Starter Map Example

[https://gis.in.gov/apps/isdh/lhd/map.htm](https://gis.in.gov/apps/isdh/lhd/map.htm)

## GeocodedPoints (.csv) - Excel

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ObjectID</td>
<td>Loc_name</td>
<td>Geo_Description</td>
<td>Score</td>
<td>Match_addr</td>
<td>X</td>
<td>Y</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
<td>TIGER_Street</td>
<td>Street Segment</td>
<td>100</td>
<td>1111 Ronald ReaganPkwy, AVON, IN, 46123</td>
<td>-86.3437</td>
<td>39.78174</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>TIGER_Street</td>
<td>Street Segment</td>
<td>100</td>
<td>1115 Ronald ReaganPkwy, AVON, IN, 46123</td>
<td>-86.3437</td>
<td>39.78283</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
<td>IDSI_Address</td>
<td>Address Point</td>
<td>89.04</td>
<td>182 South 550 East, AVON, IN, 46123</td>
<td>-86.4299</td>
<td>39.75895</td>
</tr>
<tr>
<td>5</td>
<td>3</td>
<td>IDSI_Address</td>
<td>Address Point</td>
<td>100</td>
<td>3700 CLARKS CREEK Road, PLAINFIELD, IN, 46168</td>
<td>-86.3722</td>
<td>39.70849</td>
</tr>
<tr>
<td>6</td>
<td>4</td>
<td>TIGER_Street</td>
<td>Street Segment</td>
<td>100</td>
<td>255 Meadow Dr, DANVILLE, IN, 46122</td>
<td>-86.4996</td>
<td>39.76413</td>
</tr>
<tr>
<td>7</td>
<td>5</td>
<td>IDSI_Address</td>
<td>Address Point</td>
<td>89.04</td>
<td>445 South 525 East, AVON, IN, 46123</td>
<td>-86.4324</td>
<td>39.75575</td>
</tr>
<tr>
<td>8</td>
<td>6</td>
<td>IDSI_Address</td>
<td>Address Point</td>
<td>100</td>
<td>1000 East MAIN St, DANVILLE, IN, 46122</td>
<td>-86.5014</td>
<td>39.76183</td>
</tr>
<tr>
<td>9</td>
<td>7</td>
<td>IDSI_Address</td>
<td>Address Point</td>
<td>100</td>
<td>722 Prairie Drive, BROWNSBURG, IN, 46112</td>
<td>-86.3972</td>
<td>39.83194</td>
</tr>
<tr>
<td>10</td>
<td>8</td>
<td>IDSI_Address</td>
<td>Address Point</td>
<td>100</td>
<td>1010 HORNADAY Road, BROWNSBURG, IN, 46112</td>
<td>-86.3833</td>
<td>39.83022</td>
</tr>
<tr>
<td>11</td>
<td>9</td>
<td>TIGER_Street</td>
<td>Street Segment</td>
<td>100</td>
<td>110 Greenacre Dr, BROWNSBURG, IN, 46112</td>
<td>-86.3957</td>
<td>39.8398</td>
</tr>
<tr>
<td>12</td>
<td>10</td>
<td>IDSI_Address</td>
<td>Address Point</td>
<td>100</td>
<td>100 HOSPITAL Lane, DANVILLE, IN, 46122</td>
<td>-86.5027</td>
<td>39.76145</td>
</tr>
<tr>
<td>13</td>
<td>11</td>
<td>IDSI_Address</td>
<td>Address Point</td>
<td>100</td>
<td>8110 NETWORK Drive, PLAINFIELD, IN, 46168</td>
<td>-86.3784</td>
<td>39.6521</td>
</tr>
<tr>
<td>14</td>
<td>12</td>
<td>IDSI_Address</td>
<td>Address Point</td>
<td>100</td>
<td>100 HOSPITAL Lane, DANVILLE, IN, 46122</td>
<td>-86.5027</td>
<td>39.76145</td>
</tr>
</tbody>
</table>

---

**READY**

![GeocodedPoints (5).csv](GeocodedPoints (5).csv)
Excel Function Example

https://gis.in.gov/apps/isdh/geocode/Examples/excel.htm

=WebService(url)

=WEBSERVICE("https://gis.in.gov/arcgis/rest/services/Indiana_Composite_Locator/GeocodeServer/geocodeAddresses?Addresses=['records':[{'attributes':{"SingleLine":'"&ENCODEURL(A2)"'}}]]&outFields="&outSR=4326&f=json")

=WEBSERVICE("https://gis.in.gov/arcgis/rest/services/ISDH/EnhancedBlocks/FeatureServer/0/query?geometry="&E2&"%2C"&D2&"39.7&geometryType=esriGeometryPoint&inSR=4326&spatialRel=esriSpatialRelIntersects&outFields="&returnGeometry=false&f=json")

R (RFiddle) Example
Finding A Single Address
http://www.r-fiddle.org/#/fiddle?id=kX76pIImf&version=5

Rfiddle Example shows geocoding of a single line address. The R example on the Documentation Page also includes code to geocode a csv list of addresses and save the results to a csv file.
QUESTIONS ABOUT GEOCODING?