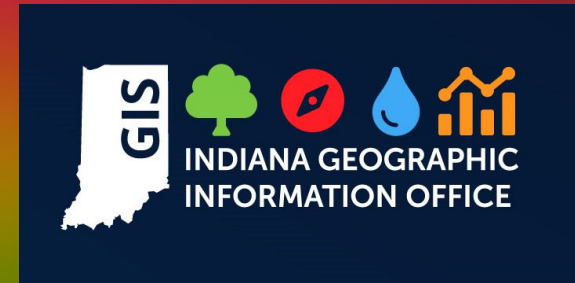




**sanborn**

www.sanborn.com  
1.866.726.2676



## Indiana Office of Technology Geographic Information Office

### 2021 - 2024 Indiana Orthoimagery Program – Overview and Buy-ups

January 8, 2021 11:30 am EST

Shaun Scholer - Point of Contact, (POC)  
GIS Program Director

Megan Compton, MPA  
Indiana Geographic Information Officer

Shawn Benham, PMP  
Project Manager

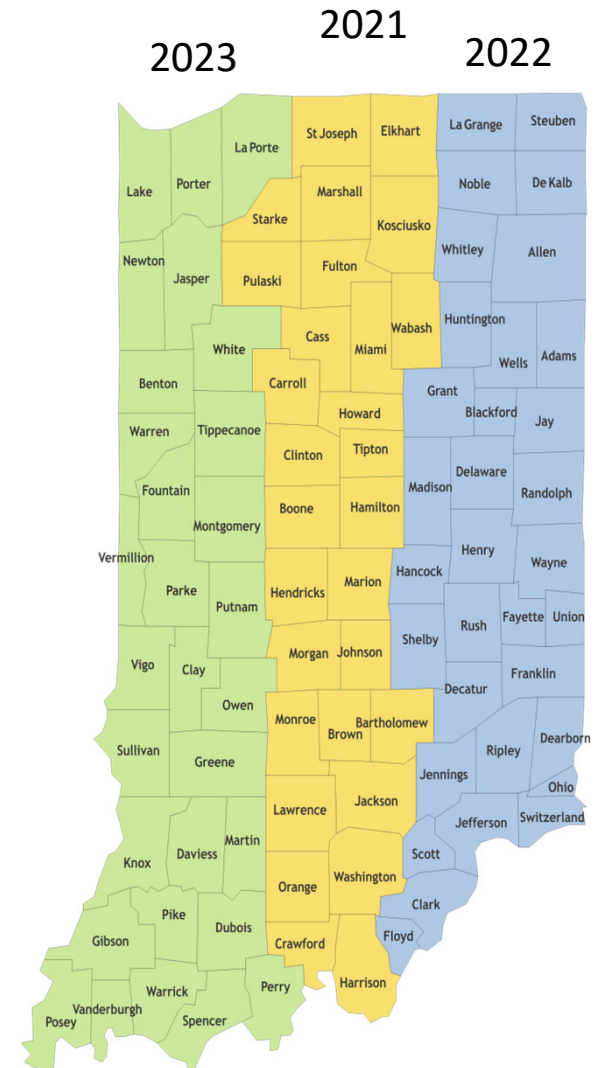
Brad Arshat, CP, EIT  
Director, Strategic Accounts



sanborn | [www.sanborn.com](http://www.sanborn.com)  
1.866.726.2676

# Indiana Statewide Programs

- **2021-2024 Ortho – 6"**
- 2016-2019 Ortho – 1'
- 2011-2014 Ortho – 1'
- 2005-2006 Ortho - 1'





sanborn | [www.sanborn.com](http://www.sanborn.com)  
1.866.726.2676

## Indiana Statewide Program - Development

- **Workgroup represented by**  
*(state, county, education and retirees)*
  - Created survey for Indiana's Orthoimagery needs
  - Developed Orthoimagery RFP
  - Members of the RFP team reviewed all proposals and presentations
  - Team and IDOA made a recommendation





sanborn | [www.sanborn.com](http://www.sanborn.com)  
1.866.726.2676

## Indiana Statewide Program Management

- Administered through Indiana Geographic Information Office (GIO)

ALL Inquires



**Shaun Scholer**

Indiana Geographic Information Office



Sanborn



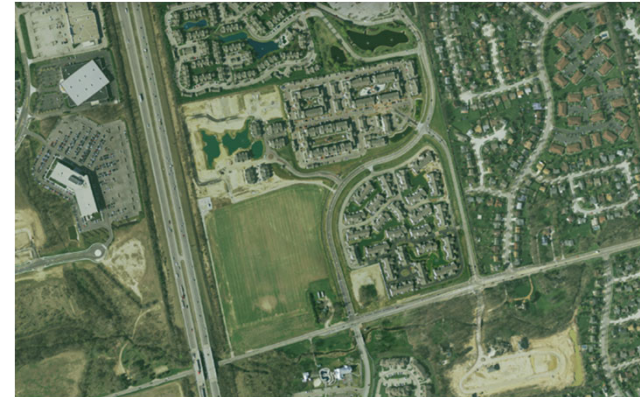




sanborn | [www.sanborn.com](http://www.sanborn.com)  
1.866.726.2676

## Indiana Statewide Program - Benefits

- **FREE 6-inch Orthophotography**
- Contract Management
- Statewide coordination and shared resources
- Coordinated QA/QC  
INDOT (Aerial Surveys)
- Data Distribution  
(web services and download)

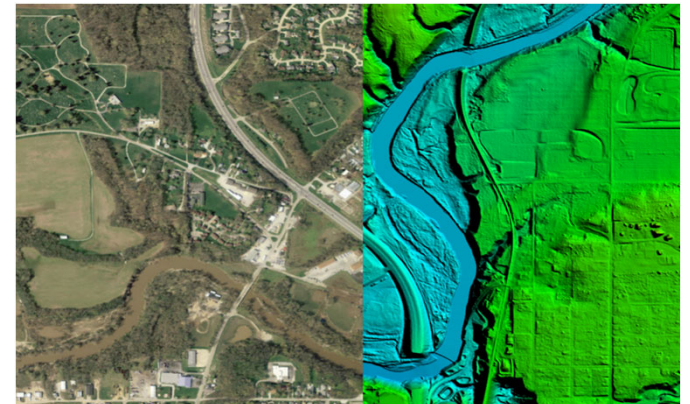




sanborn | [www.sanborn.com](http://www.sanborn.com)  
1.866.726.2676

## Indiana Statewide Program - Specification

- **Base Products**
  - 6-inch (15-cm) Pixel Resolution
  - 4-Band Imagery (R,G,B, NIR)
  - GeoTIFF Tiles
- **Additional Products**
  - Compressed County Mosaic
  - Compressed Tiles





sanborn | [www.sanborn.com](http://www.sanborn.com)  
1.866.726.2676

## Indiana Statewide Program - Funding

- Indiana Office of Technology (IOT)
- Indiana Department of Transportation (INDOT)
- Additional Partnerships



## Indiana Statewide Program Buy-Ups

- Buy-up options will be available to Indiana cities, counties and other partners
- Buy-up options include:
  - 3-inch resolution orthoimagery
  - Off year purchasing
  - Ancillary products (sample listing)
    - Oblique aerial photography
    - Lidar
    - Planimetric features
    - Contours

**Contact [Shaun Scholer](#)  
for more information**

## Indiana Statewide Program – Distribution

- **Indiana Counties**
  - Counties will receive their data directly from Sanborn via download
- **Public**
  - The Indiana Geographic Information Office (GIO) will receive a copy of all products purchased from this contract and will make these products available to the public
    - These products will be provided free of charge via download and web services



sanborn | [www.sanborn.com](http://www.sanborn.com)  
1.866.726.2676



## Sanborn Company Overview

- Founded in 1866
- Full service, dedicated geospatial solution provider
- 125 employees in 4 locations nationwide
- Quality-oriented company and culture
  - Corporate Quality Management System derived from ISO principles





sanborn | [www.sanborn.com](http://www.sanborn.com)  
1.866.726.2676



Chronology of Service Offerings	
Service	Offered Since
Ground Surveys	1866
Aerial Photography	1966
Photogrammetric Mapping	1966
Digital Photogrammetric Mapping	1979
Digital Terrain Modeling	1984
Digital Orthophotography	1988
Lidar	1998
Digital Vertical Aerial Imagery	2004
Digital Oblique Aerial Imagery	2011
UAS Operations	2013
HD Mapping	2014
24 Hour Emergency Response	2016
Large Area UAS Processing	2017
Proprietary Oblique Camera	2018

## Recent State-Level Mapping Programs

- New York
- Virginia
- Maryland
- Connecticut
- Michigan
- Arkansas
- North Carolina
- Louisiana
- Vermont



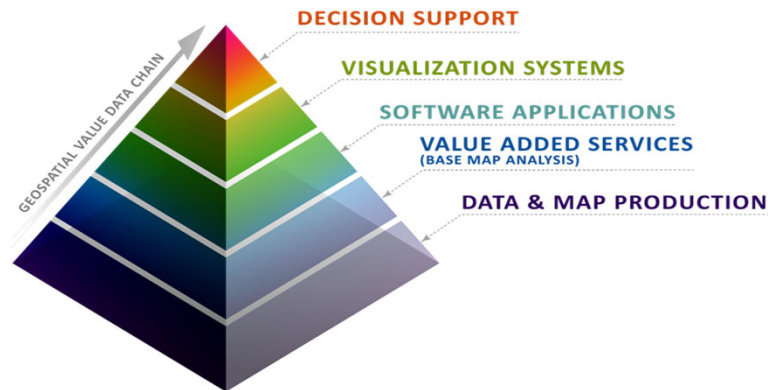


sanborn | [www.sanborn.com](http://www.sanborn.com)  
1.866.726.2676



## Sanborn Overview – Comprehensive Geospatial Solutions

- **Data Map Production**
  - LiDAR, Digital Oblique & Orthoimagery, Photogrammetric, Topographical Maps
- **Value-Added Services**
  - Land use and land cover analyses
  - Change detection
  - Other imagery analysis services/viewers



### Decision Support Systems

Wildfire Management  
Forestry and Ecosystem Management  
Emergency Response

### Visualization Systems

2D  
3D  
Prism 4D  
Common Operating Picture

### Software Applications

GIS Software Development  
Cloud Services  
Portals and Distribution Tools





sanborn | [www.sanborn.com](http://www.sanborn.com)  
1.866.726.2676

## 2021 Program Overview



- Central portion of Indiana
- Total Project Area ~ 11,783 mi<sup>2</sup>
- 6-inch spatial resolution
- 4-band RGBN, 8-bits per channel
- Accuracy of 2-pixels (12-inches) RMSE, 29-inches at 95% confidence
- Geo-referencing - Indiana State Plane East or West zone: NAD83/HARN, US Survey Feet (EPSG Codes 2967 [east] or 2968 [west])
- Tiled and County-area delivery
- Spring, snow-free, flood-free, leaf-off conditions
- Initial delivery 9-30-21. Final, post-IOT QC process delivery 11-11-21



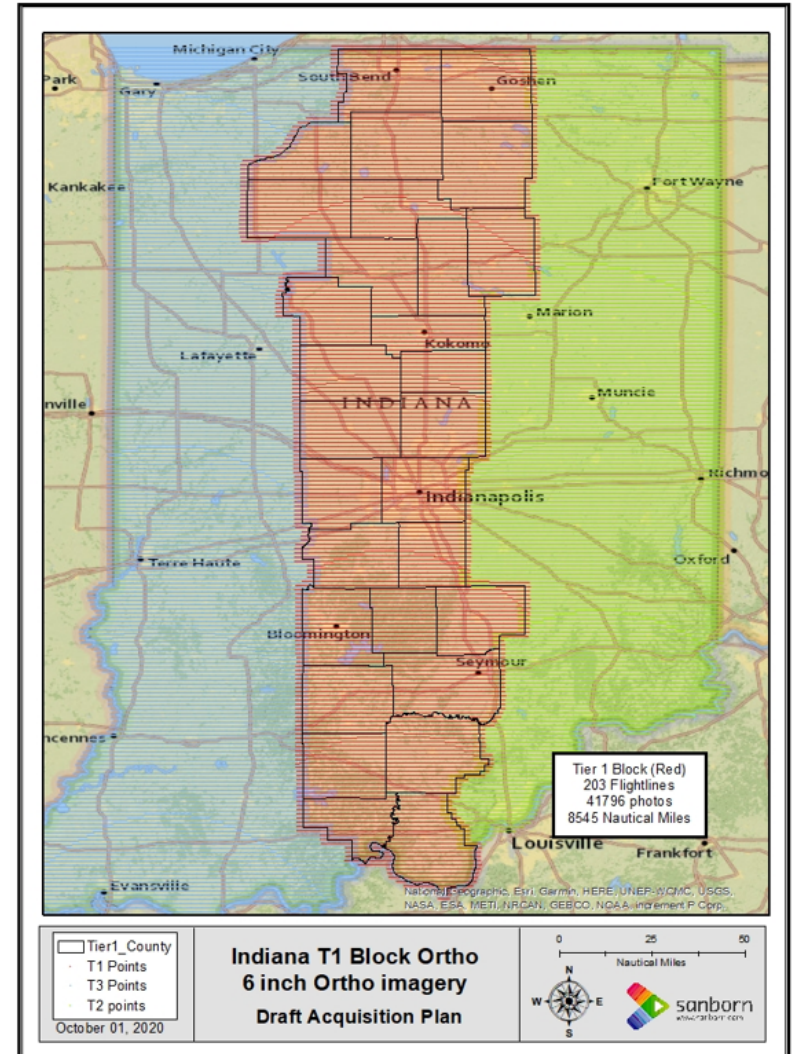
sanborn | [www.sanborn.com](http://www.sanborn.com)  
1.866.726.2676

## Imagery Acquisition

### Draft Imagery Acquisition Specifications

GSD	6-inch (15 cm)
Proposed Sensor	Vexcel Imaging UltraCam Eagle
Focal Length	100 mm
Acquisition Altitude	9,464' AGL
Aircraft Speed	175 kts
Std. Side lap	30%*
Std. End lap	80%*
Sensor Platform	Multi-Engine Fixed-Wing Aircraft
Radiometry	4-band, 14-bit per channel RGB/NIR
Acquisition Date	Spring of each Acquisition Year
Acquisition Time	~10am – 3pm
Sun Angle	30 degrees or greater
Conditions	Snow free, leaf off, no clouds, cloud shadows, or other ground obscuring conditions covering more than 5% of any image. Water bodies within natural banks.

\* Areas of dense urban development, or where true or near true orthophotography is required, will be flown at higher overlap (80% forward overlap and 60% side overlap) to minimize radial displacement of buildings and warping of elevated highway structures such as interchanges, bridges, and overpasses. Areas flown at 6-inch spatial resolution or higher will be acquired with minimum 80% forward overlap.

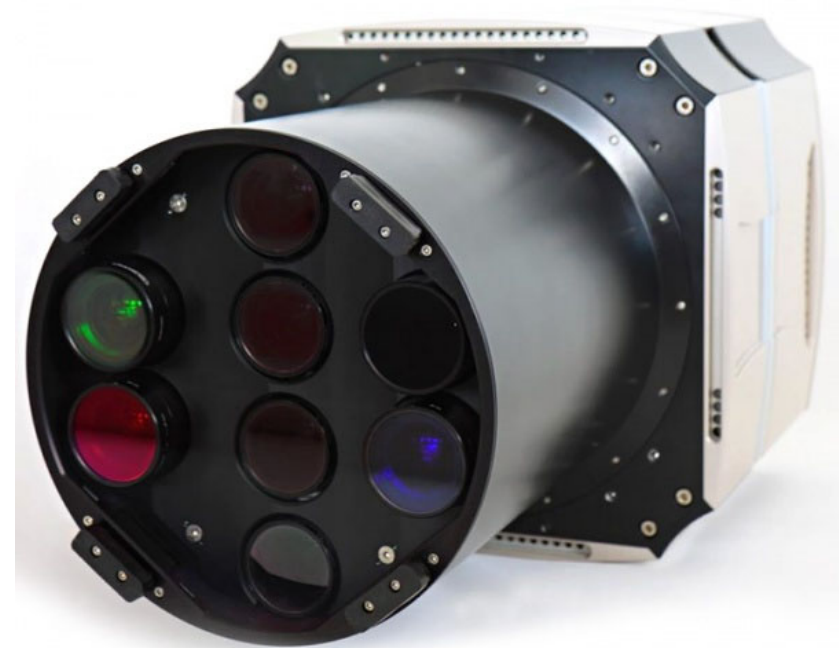




sanborn | [www.sanborn.com](http://www.sanborn.com)  
1.866.726.2676

## The UltraCam Eagle Digital Aerial Camera

- Acquisition for the program is based on the Vexcel Imaging UltraCam Eagle digital aerial camera with a 100mm lens system.
- 260 megapixels (20,010 x 13,080 pixel CCD)
- 4-band RGB/NIR collected at 16 bits per channel
- Interfaced to airborne GPS and IMU subsystems for sensor position & orientation
- Gyro-stabilized camera mounts
- 56 aircraft and 7 UltraCam Eagle cameras available through the Sanborn team. Three (3) cameras needed for annual acquisition tiers.



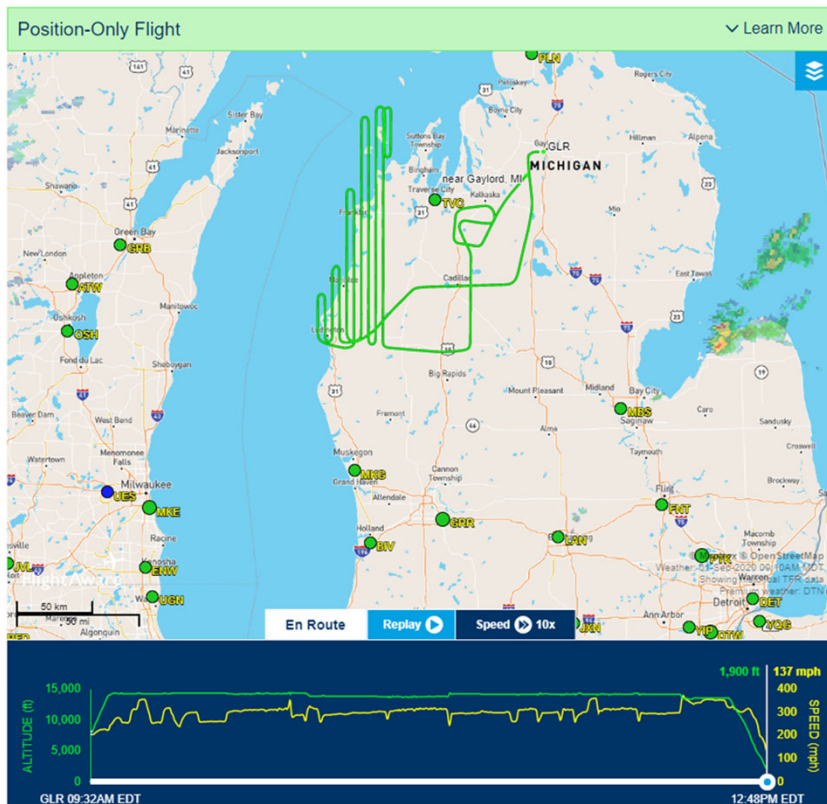




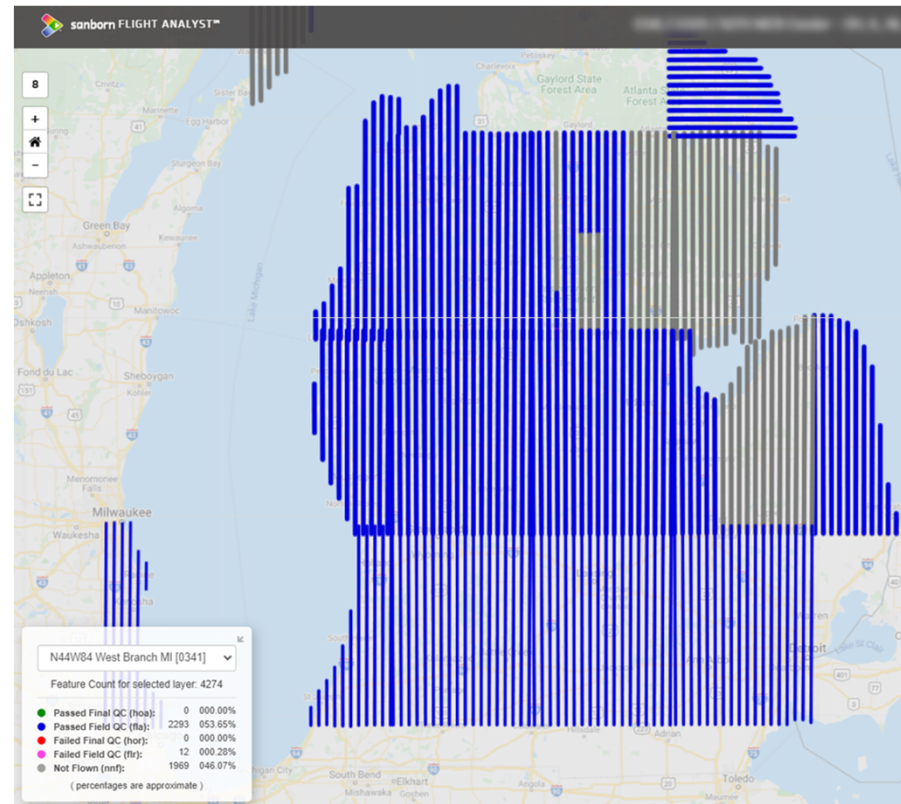
sanborn | [www.sanborn.com](http://www.sanborn.com)  
1.866.726.2676

# Acquisition Tracking and Reporting

## Real-time Tracking



## Status Reporting

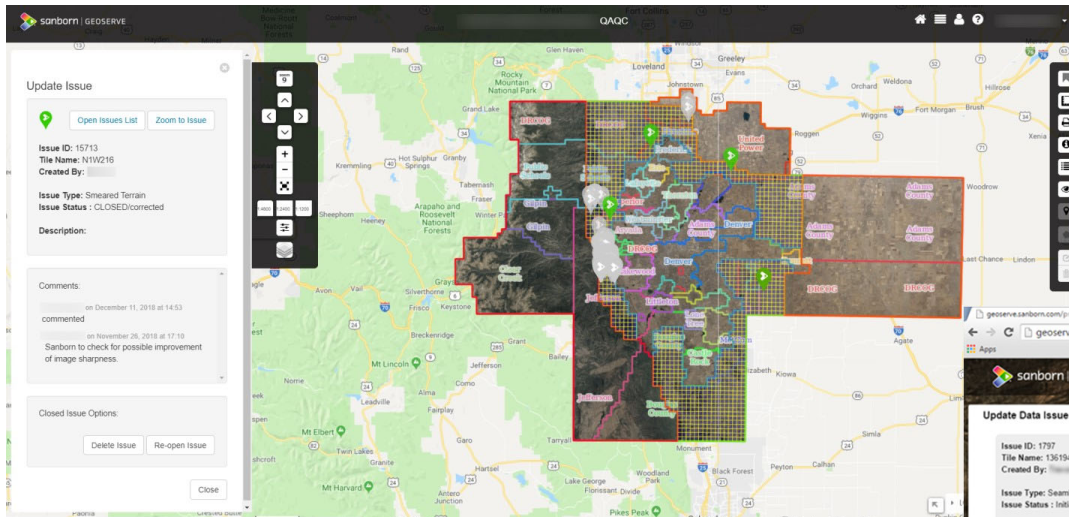




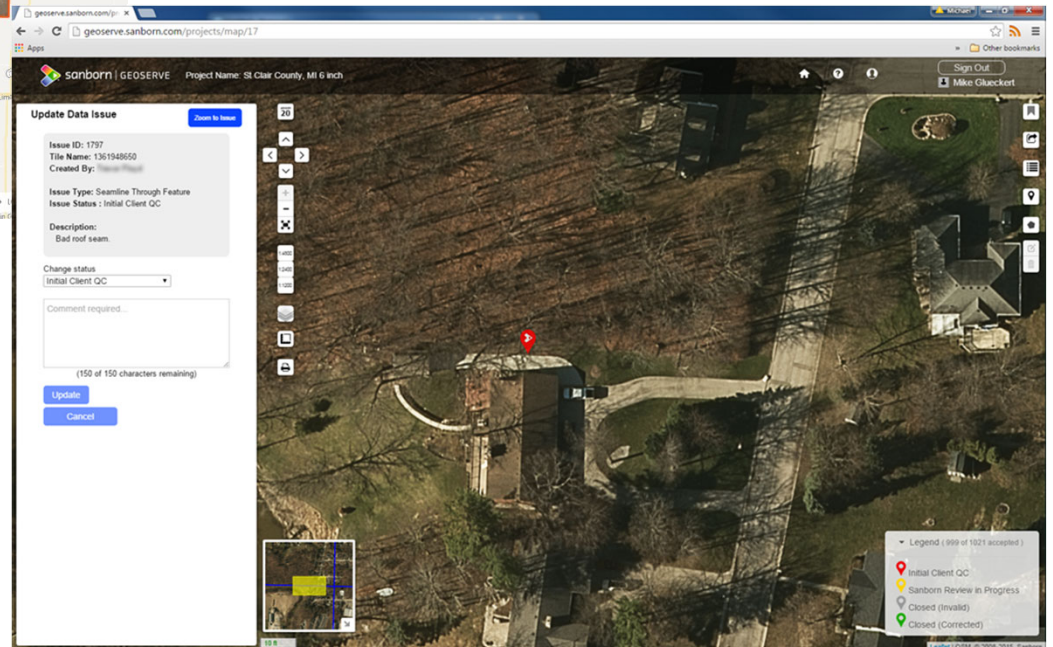
sanborn | [www.sanborn.com](http://www.sanborn.com)  
1.866.726.2676

## Early Review of Raw Imagery

- Sanborn's browser-based Image QC™ application provides the ability to review and comment on imagery within 10 days of acquisition.
- Log-in access, as granted by the State



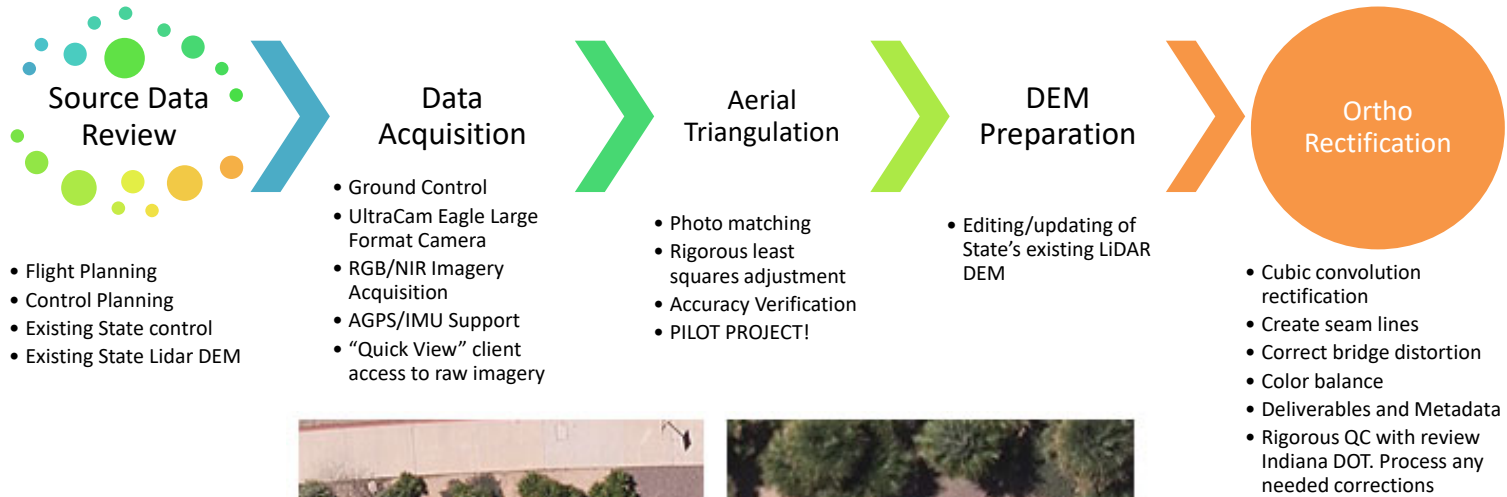
- Imagery is geo-referenced only. No color-balancing or other corrections performed at this point.
- WMS access also possible





sanborn | [www.sanborn.com](http://www.sanborn.com)  
1.866.726.2676

## Technical Approach Summary for Orthoimagery



6-inch



3-inch



## Projected Milestones – 2021 Central Tier

Projected Milestones - 2021 Central Tier	
Activity	Completion Date
Project Kickoff, Flight/Control Planning Complete	January 2021
Paneling and/or survey of ground control	February - March 2021
Imagery Acquisition	Early Feb - Early March, weather and ground conditions pending
imagery Quickview via Image Analyst	Online 10 days from completion of acquisition
Pilot Product Delivery to State for Review	May 7, 2021
Imagery Production	May – Sept. 2021
Orthoimagery Delivery via WMTS, and Online QC Analyst	Complete by 9/30/2021
QC/Review Period per County	30-days from Delivery



sanborn | [www.sanborn.com](http://www.sanborn.com)  
1.866.726.2676

# Buy-up Overview

- **Options Impacting Spring Airborne Data Acquisition (15-Feb deadline)**
  - Higher-resolution orthophotography
  - True orthophotography
  - Airborne LiDAR
  - Oblique Imagery
- **Options with No Impact to Airborne Data Acquisition (No deadline)**
  - Planimetric mapping – New or updating
  - Land cover/land use/impervious surfaces mapping
  - Contours
  - 3D buildings and infrastructure modeling
  - Other derivative data sets





sanborn | [www.sanborn.com](http://www.sanborn.com)  
1.866.726.2676

## High Resolution Orthophotography



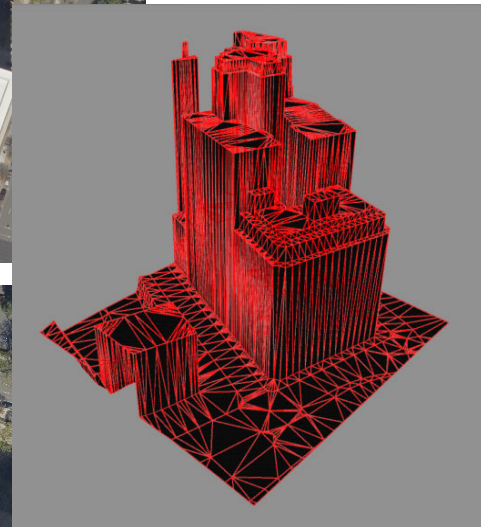
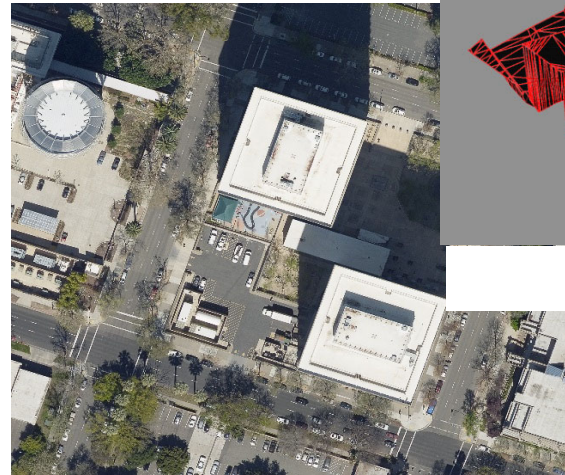
- 3-inch spatial resolution
- 4-band RGB/NIR, 8-bit per channel
- Requires additional flying, control, and enhanced DEM accuracy
- Benefits include:
  - Higher accuracy
  - Ability to see and extract smaller features
  - Ability to support additional applications such as engineering design, traffic & transportation (pavement condition, lane striping, parking studies), utility mapping, vegetation identification, code enforcement, assessment, and logistical planning.



sanborn | [www.sanborn.com](http://www.sanborn.com)  
1.866.726.2676

## True Orthophotography

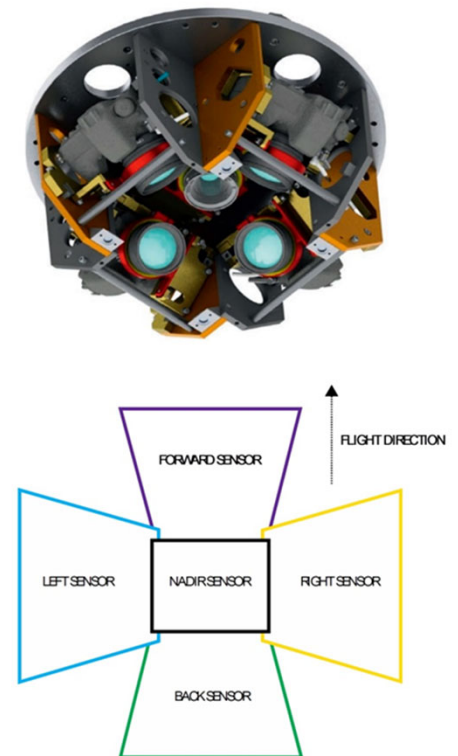
- A consideration in urban cores with tall buildings, generally >5 stories
- Orthorectifies buildings, not just the terrain surface – eliminates “building lean”
- In addition to putting each building in true map position, it helps expose otherwise hidden “urban canyons”.
- Requires supplemental high-overlap imagery, and high sun-angle acquisition time
- Requires 3D modeling of buildings





# Oblique Imagery

- Full-color imagery provides complete 5-view coverage your chosen project area
  - 4 oblique views (45 degrees) + 1 vertical
  - Vertical image is 4-band RGB/NIR
- Available resolutions from 2 inches to 12 inches+
- 2- to 3-pixel accuracy
- Licensed product, but:
  - No usage, sharing or deployment restrictions
  - No “per seat” costs
  - Right to use never expires



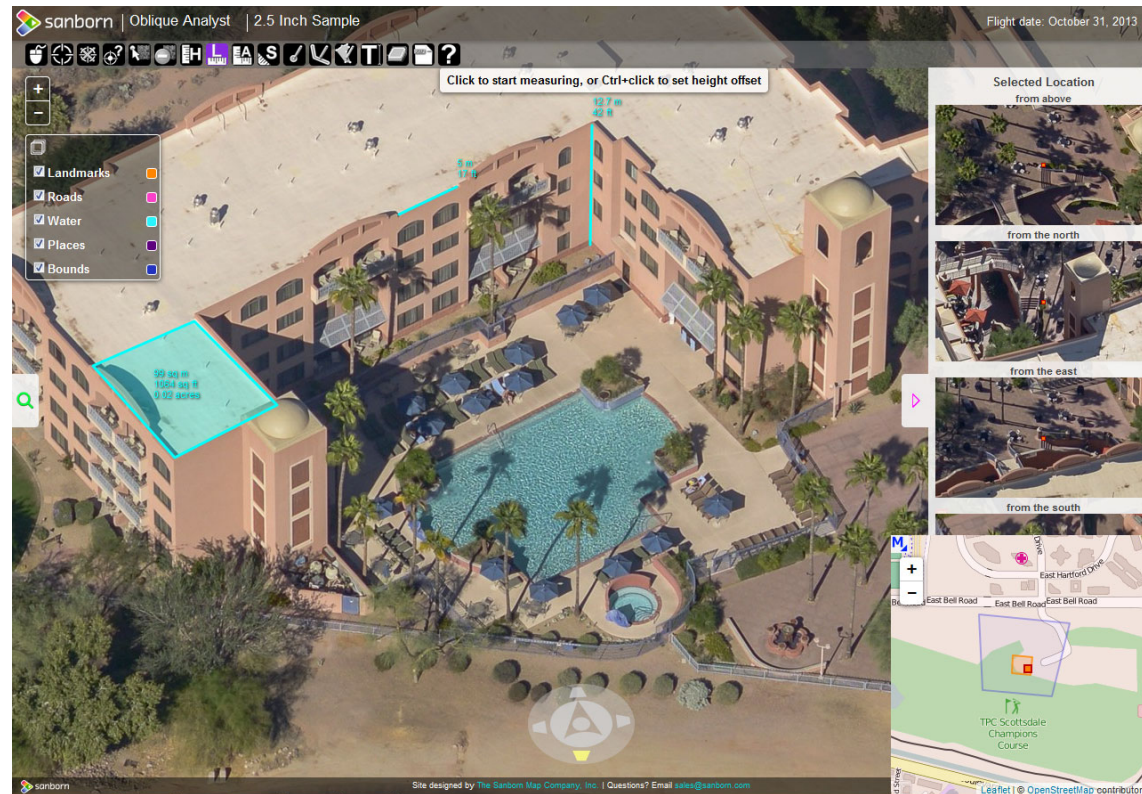


sanborn | [www.sanborn.com](http://www.sanborn.com)  
1.866.726.2676

# Sanborn Oblique Analyst®

Capabilities include:

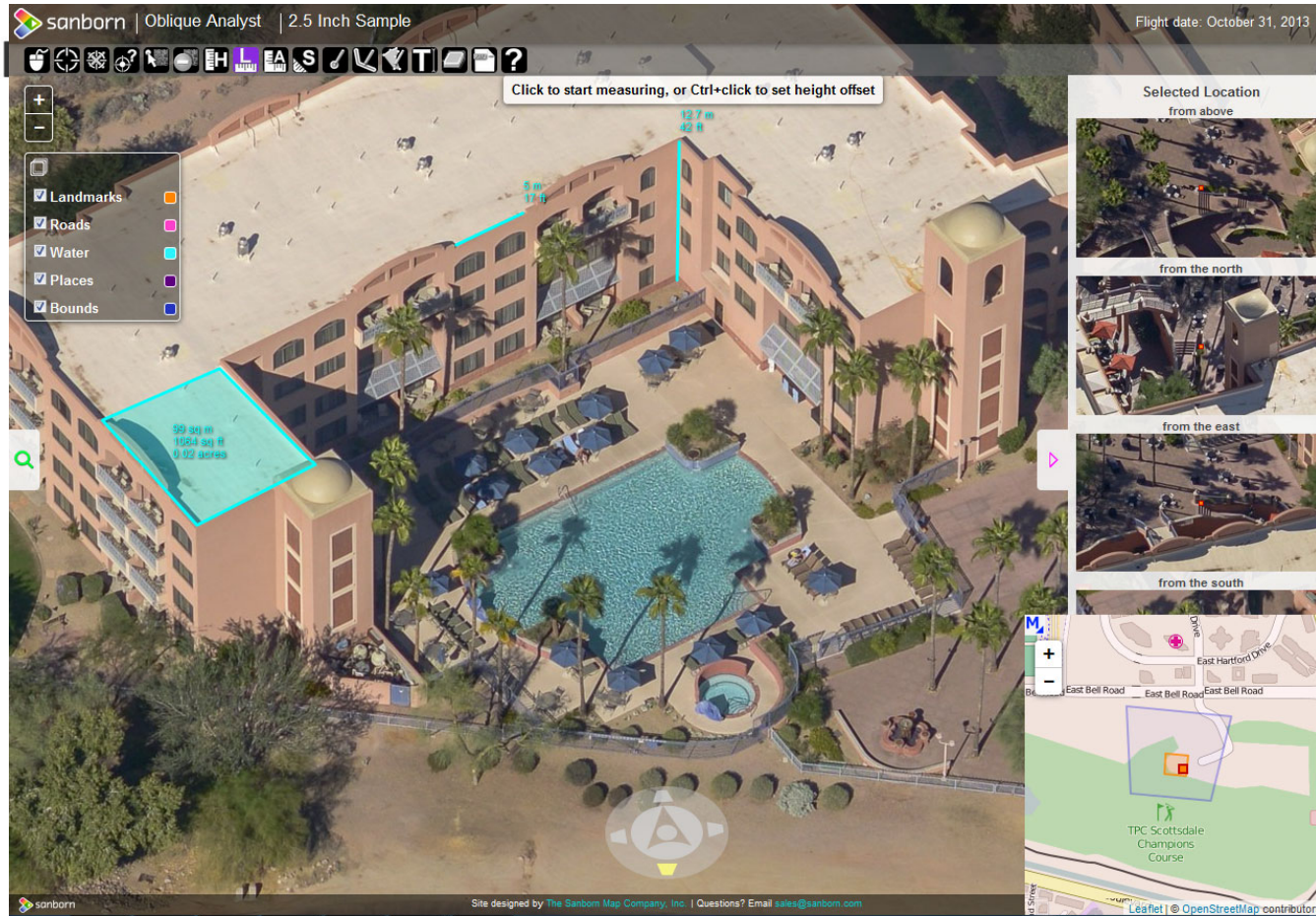
- Search by address
  - Search by Parcel ID Number
  - Pan, zoom
  - Set a location
  - Show coordinates
  - Measure Height
  - Measure Length
  - Measure Area
  - Measure Slope
  - Draw (add) Point
  - Draw (add) Line
  - Draw (add) Polygon
  - Draw (add) Text
  - Erase Drawings
  - Clear Location
  - Create PDF
  - Ingest shapefiles
  - Help Documentation
- Can be integrated with CAMA and E911 CAD systems
  - Custom services such as change detection, data hosting, are also available







sanborn



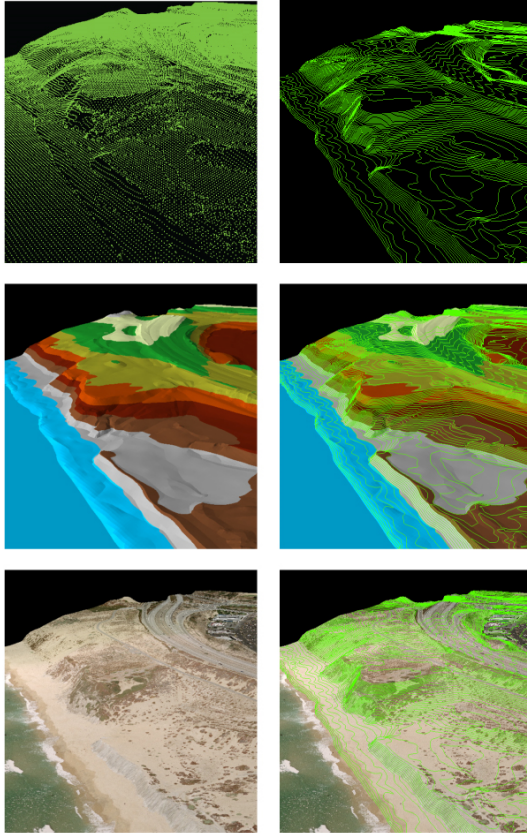
Sanborn Oblique Analyst® Demo Link:  
<https://oblique.sanborn.com/Hennepin/>





sanborn | [www.sanborn.com](http://www.sanborn.com)  
1.866.726.2676

# Airborne LiDAR

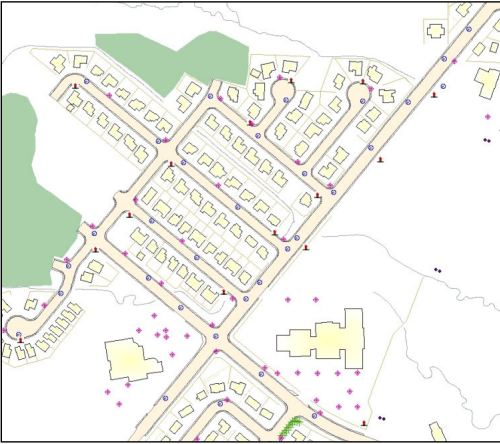


- Fully compliant with USGS-National Geospatial Program (NGP) per current LiDAR Base Specification v2.1
- Quality Level 2 (2 pts/m<sup>2</sup>) or Quality Level 1 (8 pts/m<sup>2</sup>)
- Note that spatial accuracy of QL-2 and QL-1 lidar is the same.
- Delivery of raw point cloud, classified point cloud, hydro-flattened DEM.
- Supports creation of 1-foot contours
- Other enhancements and derivative data sets can be produced – enhanced classification, hydro-enforcement, DSM's, contours, etc.



sanborn | [www.sanborn.com](http://www.sanborn.com)  
1.866.726.2676

# Planimetric Mapping

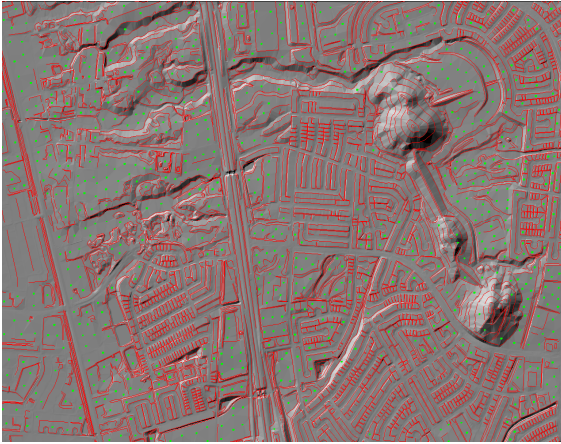


- Vector mapping of visible features
- Fully customizable data sets – can be complete mapping or selected features only, e.g. buildings
- Formatted to your geodatabase design specifications
- All feature data extraction performed using stereo-photogrammetric techniques – no “heads up digitizing” from orthos
- Additional classification such as pervious/impervious can be performed
- GIS or CAD data formats, 2D or 3D
- Old data sets are often cheaper to replace than to update
  - Searching for changes takes a lot of time
  - Specs of legacy data are often unknown
- Pricing is highly scope and feature density dependent – custom quotes will be provided

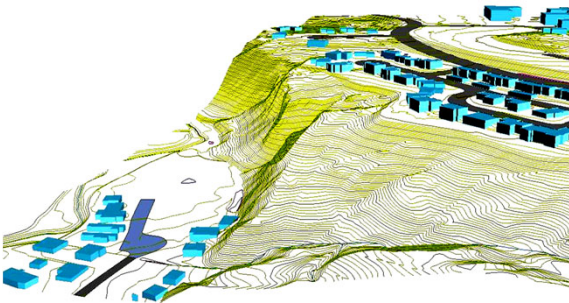


sanborn | [www.sanborn.com](http://www.sanborn.com)  
1.866.726.2676

# Contour Development



- Can be derived from lidar or imagery-derived DEM's
- Breakline enhancement performed as required
- Created at the desired interval (1-foot, 2-foot)
- ASPRS accuracy
- Fully attributed or layered to discriminate index contour, index depression contour, obscured index contour, obscured index depression contour, intermediate contour, intermediate depression contour, obscured intermediate contour, obscured intermediate depression contour, and hidden contour.
- GIS and CAD data formats



## Enhanced LiDAR Point Cloud Classification

- The classification process discriminates raw LiDAR points into defined categories
- The objective for USGS LBS v2.1 and is mainly to separate ground points from non-ground points
- Custom, enhanced classification schemes can discriminate buildings, vegetation, etc.
- Cost is function of complexity of classification scheme and feature density.

USGS LBS v2.1 Classification	
Class 1	Processed, but unclassified
Class 2	Bare-earth ground
Class 7	Low noise
Class 9	Water
Class 17	Bridge decks
Class 18	High noise
Class 20	Ignored ground (breakline proximity)

Sample Enhanced Classification Scheme	
Class 1	Processed but unclassified
Class 2	Bare earth
Class 3	Low Vegetation
Class 4	Medium Vegetation
Class 5	High Vegetation
Class 6	Building
Class 7	Low noise
Class 9	Water
Class 17	Bridge decks
Class 18	High noise

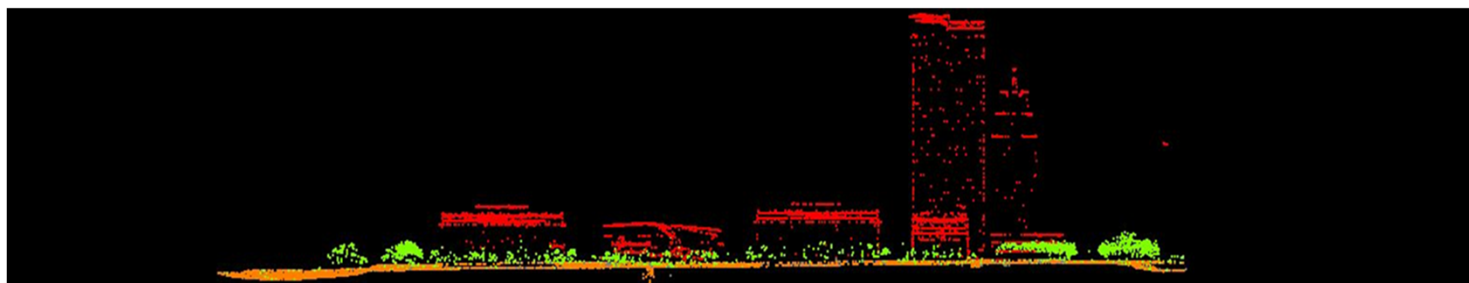
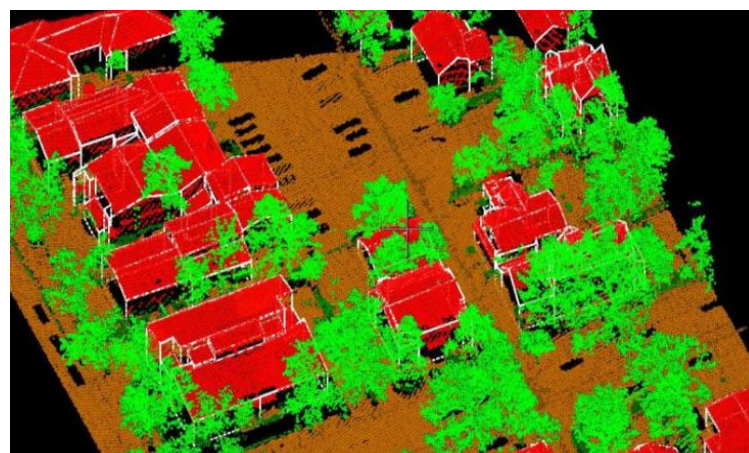
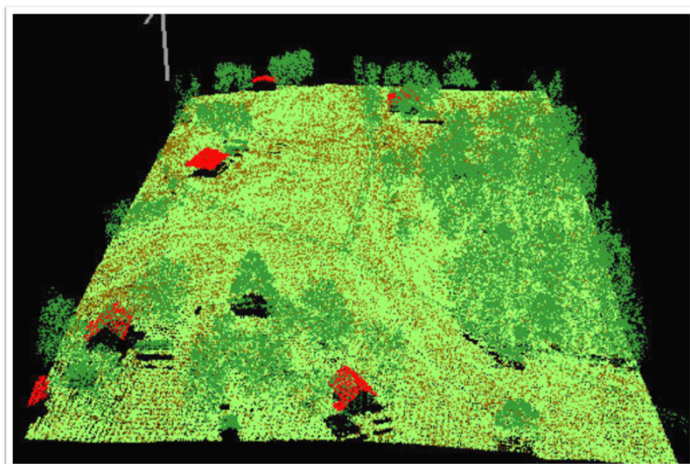




sanborn | [www.sanborn.com](http://www.sanborn.com)  
1.866.726.2676



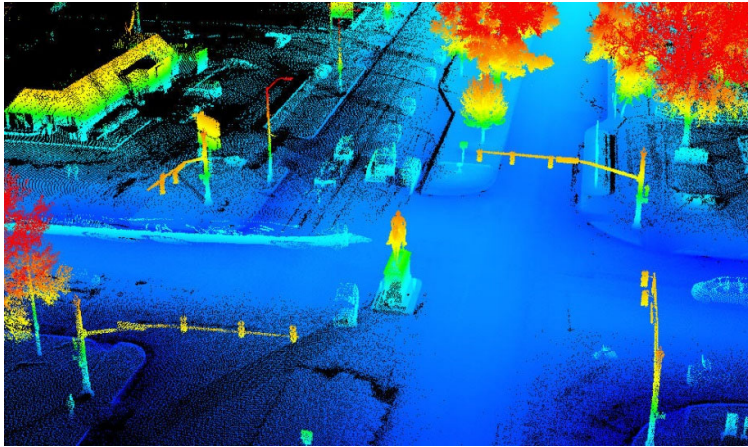
# Enhanced LiDAR Point Cloud Classification



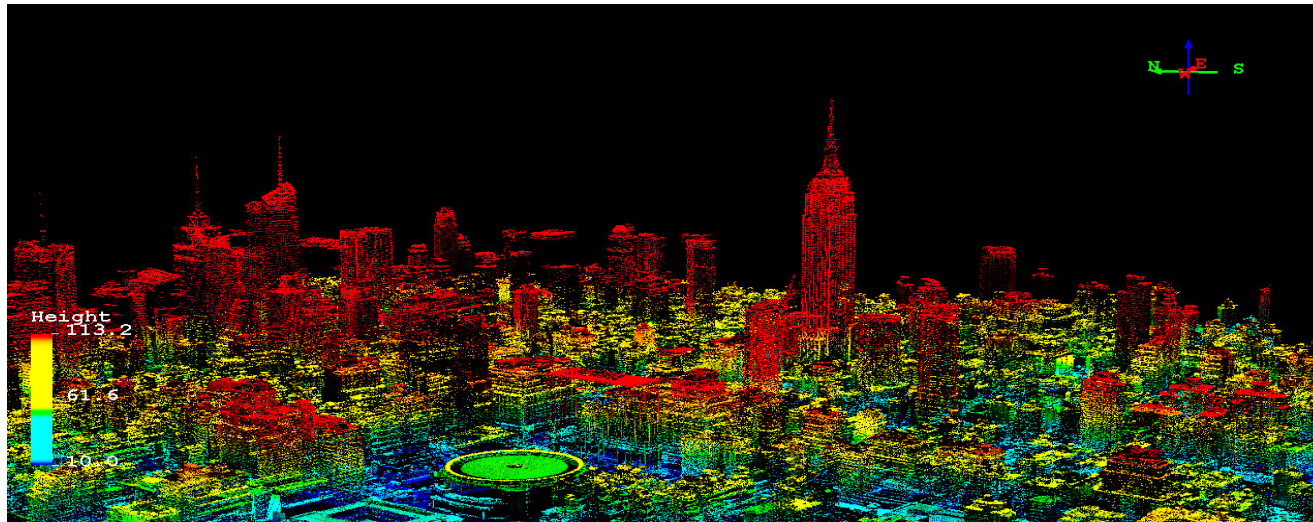


sanborn | [www.sanborn.com](http://www.sanborn.com)  
1.866.726.2676

# LiDAR Digital Surface Model (DSM)



- A DSM represents the first return or first strike of all LiDAR points
- Includes all above ground features, as well as unobstructed terrain
- Urban & transportation planning, line of site analysis, wireless signal propagation, airport obstruction studies

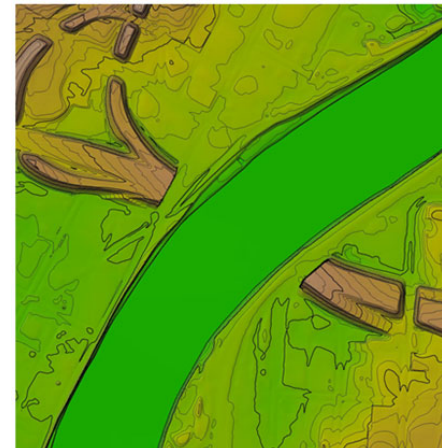
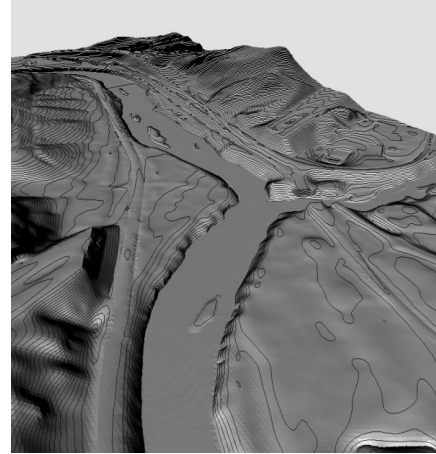




sanborn | [www.sanborn.com](http://www.sanborn.com)  
1.866.726.2676

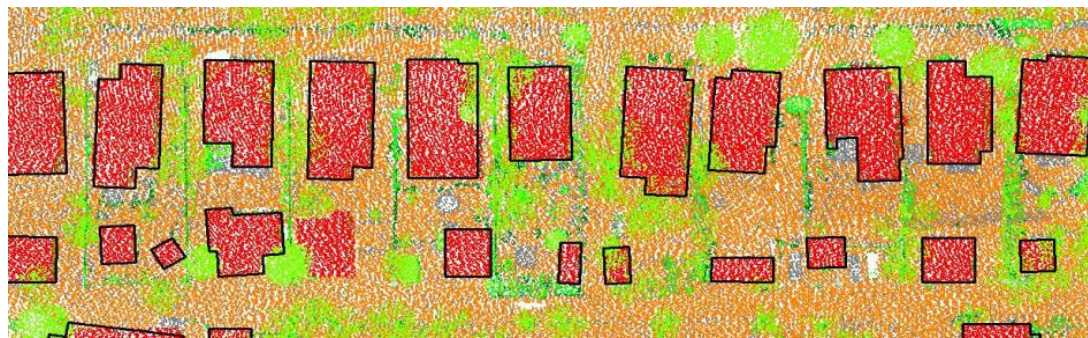
# LiDAR Hydro Conditioning and Enforcement

- Hydro Conditioning and Enforcement produce hydrologic, not topographic surfaces, and:
  - Are used for hydrological modeling, not topographic mapping
  - Are NOT a goal or requirement of USGS LBS v2.1
- Hydro Conditioning:
  - Ensures that the flow of water is continuous across the entire terrain surface, whether water flow is in a stream channel or not
  - Includes removal of all spurious sinks or pits in the terrain surface
- Hydro Enforcement
  - Applies to mapped drainage features such as lakes, streams, and culverts, not the overall terrain surface
  - Similar to hydro-flattened surface, but includes the removal of terrain over culverts, and other obstructions to hydrologic continuity, and additional breakline enhancement to ensure accurate flow modeling

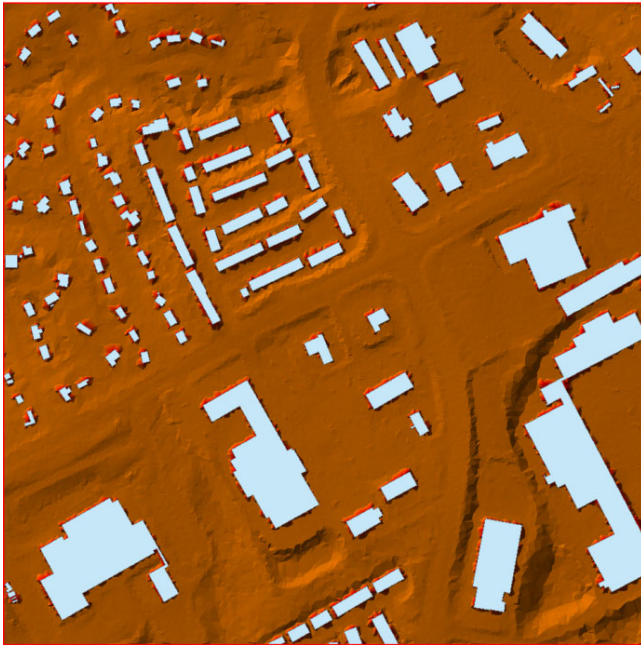




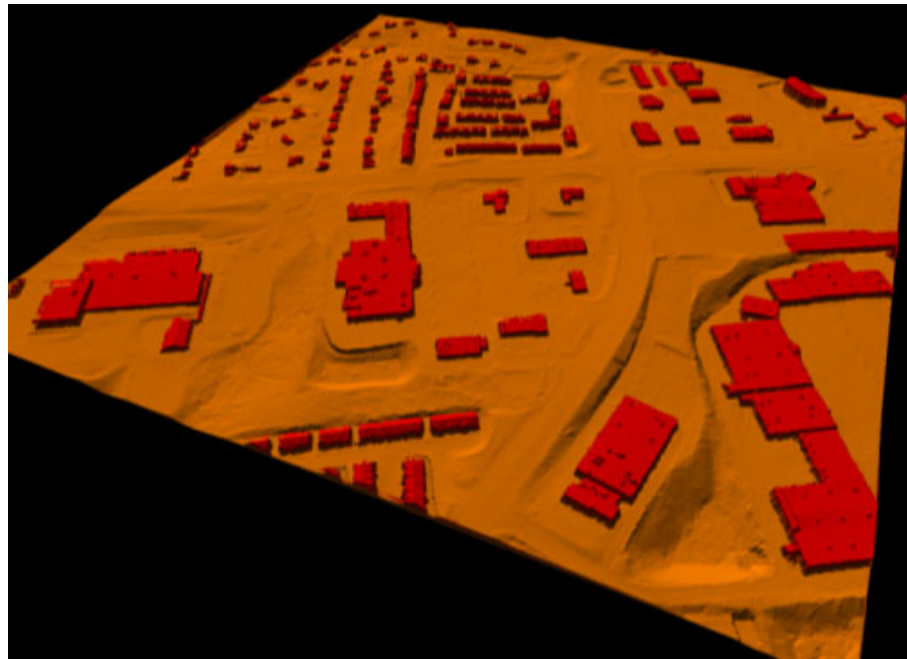
## Building Extraction from LiDAR



- Can be 2D outlines or 3D wire frames
- Rapid and cost effective compared to imagery-based stereo photogrammetric or heads-up digitizing techniques
- Semi-automated process
- 80-90% geometric accuracy
- Delivered as 3D shapefiles



## Building Extraction from LiDAR

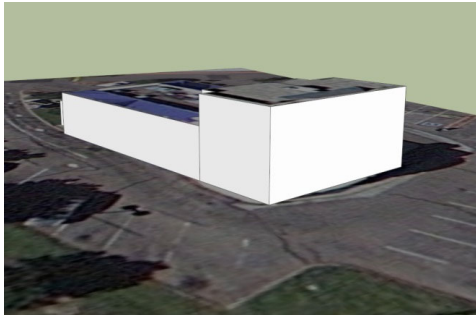




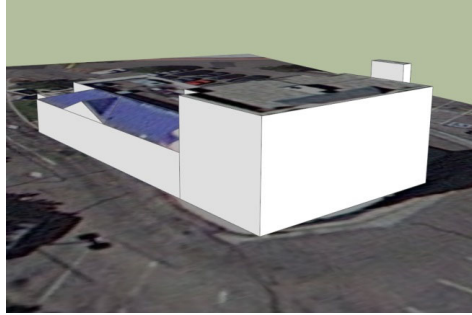
sanborn | [www.sanborn.com](http://www.sanborn.com)  
1.866.726.2676

## 3D Building Models

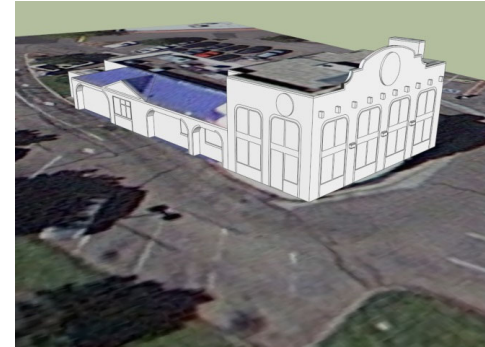
### Untextured Geometry



LOD1



LOD2



LOD3

Wide range of deliverable formats, including  
SketchUp (SKP), Collada (DAE), CityGML (XML), or  
TerraExplorerPro (XPL2)

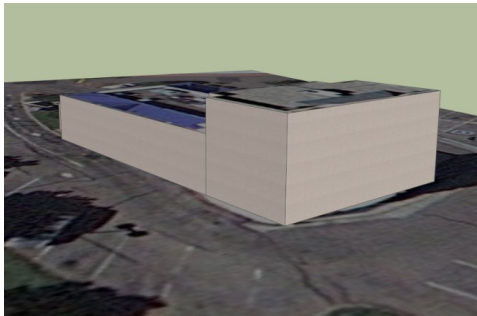




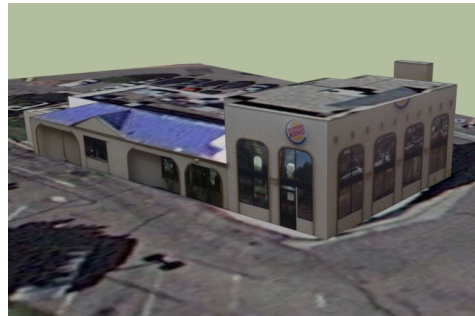
sanborn | [www.sanborn.com](http://www.sanborn.com)  
1.866.726.2676

# 3D Building Models

## Textured Geometry



LOD1 – Representative texture



LOD2 – Photo-realistic texture

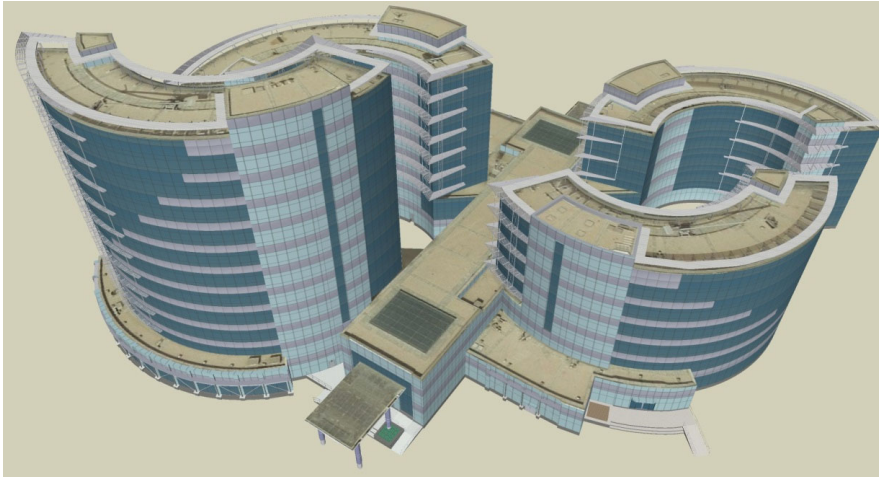


LOD3 – Photo-realistic texture



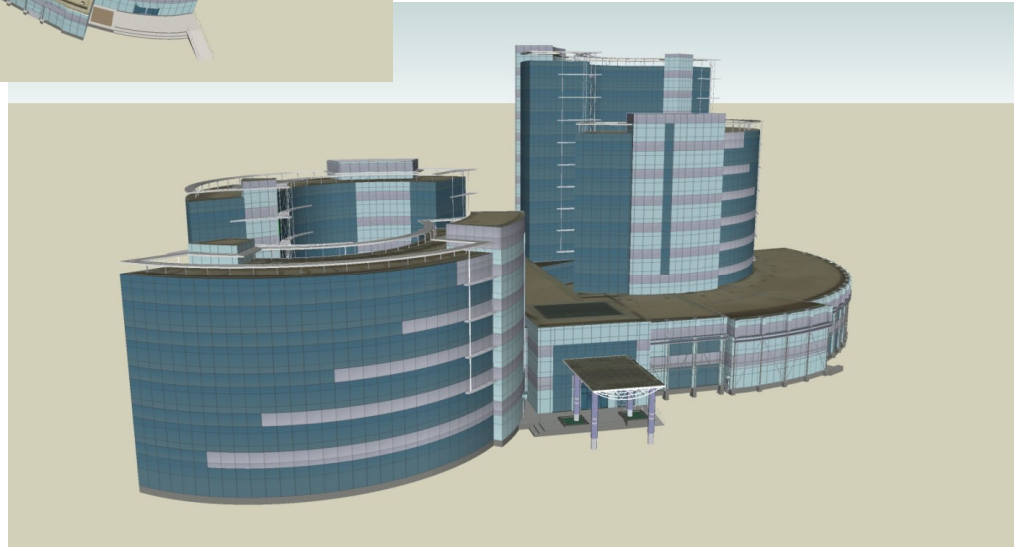
sanborn | [www.sanborn.com](http://www.sanborn.com)  
1.866.726.2676

# 3D Buildings Models



Full architectural  
geometric  
detailing

Texturing from  
oblique aerial or  
terrestrial  
photography







sanborn | [www.sanborn.com](http://www.sanborn.com)  
1.866.726.2676

## Pricing – Orthoimagery Buy-ups

3-inch Spatial Resolution Orthoimagery	
Area	Price/mi <sup>2</sup>
At least 40,000 mi <sup>2</sup>	\$ 166.00
At least 10,000 mi <sup>2</sup>	\$ 175.00
At least 2,000 mi <sup>2</sup>	\$ 205.00
At least 400 mi <sup>2</sup>	\$ 250.00
At least 36 mi <sup>2</sup>	\$ 424.00
Out of cycle, at least 400 mi <sup>2</sup>	\$ 265.00
Out of cycle, at least 36 mi <sup>2</sup>	\$ 434.00

6-inch Spatial Resolution Orthoimagery	
Area	Price/mi <sup>2</sup>
Out of cycle, at least 400 mi <sup>2</sup>	\$ 85.00

True Orthophotography – 6-inch Resolution	
Area	Price/mi <sup>2</sup>
At least 400 mi <sup>2</sup>	\$ 350.00
At least 36 mi <sup>2</sup>	\$ 850.00
At least 5 mi <sup>2</sup>	\$ 1,700.00

## Pricing – Orthoimagery Buy-ups

3-inch Spatial Resolution Orthoimagery			
Area	Price/mi <sup>2</sup>	State Contribution	Actual Buy-up Price/mi <sup>2</sup>
At least 10,000 mi <sup>2</sup>	\$175.00	\$51.39	\$123.61
At least 2,000 mi <sup>2</sup>	\$205.00	\$51.39	\$153.61
At least 400 mi <sup>2</sup>	\$250.00	\$51.39	\$198.61
At least 36 mi <sup>2</sup>	\$424.00	\$51.39	\$372.61
Out of cycle, at least 400 mi <sup>2</sup>	\$265.00	NA	NA
Out of cycle, at least 36 mi <sup>2</sup>	\$434.00	NA	NA

6-inch Spatial Resolution Orthoimagery	
Area	Price/mi <sup>2</sup>
Out of cycle, at least 400 mi <sup>2</sup>	\$ 85.00

True Orthophotography – 6-inch Resolution	
Area	Price/mi <sup>2</sup>
At least 400 mi <sup>2</sup>	\$ 350.00
At least 36 mi <sup>2</sup>	\$ 850.00
At least 5 mi <sup>2</sup>	\$ 1,700.00

## Sample Calculations

**Case #1: Assume 500 mi<sup>2</sup> county, 3-inch resolution orthoimagery upgrade**

From pricing table, cost for areas from 400 to 1,999 mi<sup>2</sup> is \$250/mi<sup>2</sup>

State covers cost of baseline imagery (\$51.39/mi<sup>2</sup>)

$$\text{Cost} = (\$250/\text{mi}^2 - \$51.39/\text{mile}^2) \times 500 \text{ mi}^2 = \$99,305$$

## Pricing – Lidar Buy-ups

Lidar – Quality Level 2 (QL-2) 2 points per square meter	
Area	Price/mi <sup>2</sup>
At least 40,000 mi <sup>2</sup>	\$ 152.00
At least 5,000 mi <sup>2</sup>	\$ 140.00
At least 400 mi <sup>2</sup>	\$ 205.00

Lidar – Quality Level 1 (QL-1) 8 points per square meter	
Area	Price/mi <sup>2</sup>
At least 40,000 mi <sup>2</sup>	\$ 165.00
At least 5,000 mi <sup>2</sup>	\$ 170.00
At least 400 mi <sup>2</sup>	\$ 275.00



## Pricing – Contour Buy-ups

Contours		
Area	1-Foot Price/mi <sup>2</sup>	2-Foot Price/mi <sup>2</sup>
At least 40,000 mi <sup>2</sup>	\$85.24	\$42.63
At least 5,000 mi <sup>2</sup>	\$85.42	\$42.81
At least 400 mi <sup>2</sup>	\$87.80	\$45.19

## Pricing – Oblique Imagery Buy-ups

6-inch Spatial Resolution Oblique Imagery*	
Area	Price/mi <sup>2</sup>
At least 40,000 mi <sup>2</sup>	\$85.00
At least 10,000 mi <sup>2</sup>	\$95.00
At least 2,000 mi <sup>2</sup>	\$105.00
At least 400 mi <sup>2</sup>	\$150.00
At least 36 mi <sup>2</sup>	\$400.00
At least 5 mi <sup>2</sup>	\$5,747.01

\*Other spatial resolutions, 2-inch to 12-inch, by custom quote

## By Custom Quotation

- Planimetric Mapping – New or Updating
- Land cover/land use/impervious surfaces Mapping
- Change detection
- Lidar enhancements and derivative products
- 3D Building and infrastructure modeling
- Cloud hosting
- Other relevant requested products and services

# Price Quotations, Ordering, Contracting

## 1 - Contact **Shaun Scholer**

Email: [sscholer@iot.in.gov](mailto:sscholer@iot.in.gov)

Phone: 317-414-0889

## 2 - Define Area of Interest and Scope of Work

- Shapefile for boundary or tile grids are preferred. Include any required buffer areas
- Sanborn will provide any needed technical information, price quotation

## 3 – Contract for buy-ups and ancillary products

- Direct contract with Sanborn contract, from state pre-agreed contract
- Acquisition-dependent buy-ups must be confirmed no later than 2-15-2021
- Other buy-ups can be ordered any time



## Project Team

### Shaun Scholer (GIO)

GIS Program Director

Cell: 317-414-0889

Email: [sscholer@iot.in.gov](mailto:sscholer@iot.in.gov)

### Megan Compton (GIO)

Geographic Information Officer

Office: 317-234-5889

Email: [mcompton@iot.in.gov](mailto:mcompton@iot.in.gov)

### Shawn Benham (Sanborn)

Project Manager

Cell: 719.502.1296

Email: [sbenham@sanborn.com](mailto:sbenham@sanborn.com)

### Brad Arshat (Sanborn)

Price Quotations, Technical Information,  
Contracts Liaison

Cell: 443-603-7725

Email: [barshat@sanborn.com](mailto:barshat@sanborn.com)

# Thank you for your Time





# Stay Informed

Indiana Geographic Information Council (IGIC)

Orthophotography/LIDAR Committee

**4<sup>th</sup> Tuesday of every month**

**Tuesday, February 23 at 11 a.m**