

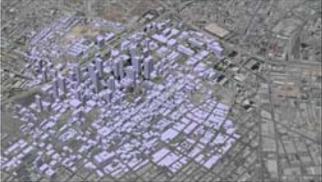
PHOTOS, LOGS, REMOTE SENSING, ELEVATION MODELS, CARTOONS, INTRAFED, DATA CONVERSION, ANALYSIS, DIGITAL MAPS, 3D MODELS, GROUND PHOTOGRAPHY, MAPPING, TRAINING

**SANBORN** Total Geographic Solutions

## Presentation to LAR-IAC for Building Outline Extraction

**Date:** January 17<sup>th</sup>, 2008  
**Location:** LA County

*Presented by: Jason Caldwell, Director of Strategic Accounts*



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## Agenda

- LA Base Map Sources
- Base Map Characteristics
- Building Outline Methods/Products
- Quality Assurance and Control
- Building Classification and Attribution
- Questions

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## LA County Existing Source Data

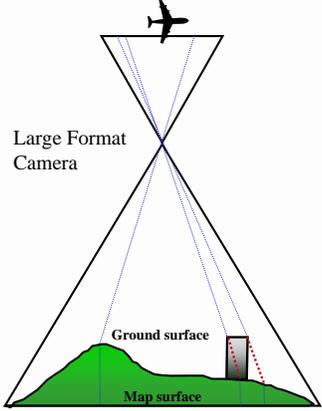
*LA County has invested significant monies in the development of base map data that can be used for planimetric extraction.*

- 2008 Ortho Imagery
  - Allows for "heads up" digitizing or automated extraction of features
  - Data can only be represented as a 2D product
- 2008 Stereo Pairs
  - Allows for the compilation of features in a stereo environment using two overlapping images.
  - Data can be represented as a 2D or 3D product
- 2006 LiDAR and Ortho
  - Allows for the automated extraction of features
  - Data can be represented in 2D or 3D format
  - Partially Obsolete

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## Characteristics of Ortho Imagery: Data Extraction with Radio Displacement




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## Building Outline Methods/Products SANBORN

1. LiDAR Automated Extraction
  - 3D building architecturally correct – Provided in TIN format and includes slope, dome and other rooftop information
2. Ortho Extraction
  - Simple building – raster product
  - Simplified building outline – 2D polygon with no elevation attribution
3. Stereo Imagery Collection
  - Simplified building outline – 2D polygon with no elevation attribution
  - Simplified building outline – 2D polygon with elevation attribute
  - 3D building block style – multiple 2D polygons with elevation attributes (2½D)
  - 3D building architecturally correct – Provided in TIN format and includes slope, dome and other rooftop information
  - 3D building with textured facades – Can use either product #4 or #5 for geometry and skins (textures) sources include oblique or terrestrial data.
    - Formats include ESRI Multipatch, VRML 2.0, 3ds Max, Openflight 15.8, Sketchup 5.0

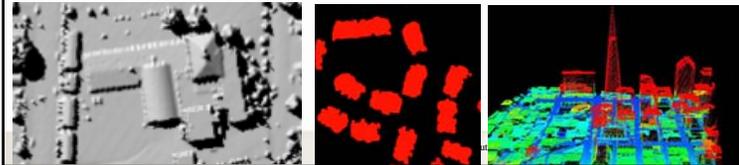
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5

## Method: LiDAR Based Extraction SANBORN

- Methodology: Using the last return data and the “bald earth” surface Sanborn can extract building outlines automatically
- Pros
  - Low Cost (using existing LiDAR)
  - Allows for Elevation Data
  - Will come close to 1”=100’ map scale accuracy
- Cons
  - Mass points do not provide for quality polygon geometry
  - Automated methods can not achieve a 98% acceptance rate
  - Typically requires specialized flight plan



## Method: Raster Based Automated Extraction SANBORN

- Methodology: Using automated feature extraction software, buildings can be collected through the analysis of the existing ortho imagery’s color, tone, location, texture, shape, and context.
- Pros
  - Buildings will align with imagery source used for digitizing (radial displacement issue)
- Cons
  - Buildings will not meet map scale accuracy
  - Buildings may not align with future imagery source (radio displacement issue)
  - Does not provide quality polygon geometry
  - Automated methods can not achieve a 98% acceptance rate
  - Inability to detect elevation change
  - Needs significant manual editing



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7

## Method: 2D Digitizing from Ortho SANBORN

- Methodology: Using the digital ortho imagery a GIS technician can trace the outline of a building based upon the location of the building on the imagery
- Pros
  - Buildings will align with imagery source used for digitizing (radio displacement issue)
  - 10-20% lower cost compared to stereo digitizing
  - Allows for topology corrected vector polygons
- Cons
  - Buildings will not meet map scale accuracy
  - Buildings may not align with future imagery source (radio displacement issue)
  - Delineation of actual outline is much more difficult to distinguish
  - Inability to detect elevation change
  - Needs significant adjustment for right angle

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8

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## Method: 3D Digitizing from Stereo Imagery

- Methodology: Using the digital stereo imagery a GIS technician can trace the outline of a building based upon the location of the building
- Pros
  - Provides the most accurate method for collection
  - 2008 imagery will allow for 1"=100' map scale accuracy and 1"=200' map scale accuracy (National Forrester)
  - Allows for single point or multi-polygon elevation data
  - Allows for topology corrected vector polygons
- Cons
  - Cost
  - Requires stereo imagery

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9

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## Data Sample: Stereo Digitizing (green, 2007) vs. Ortho Digitizing (orange, 2006)



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10

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## Simple Building Outline: 2D polygon

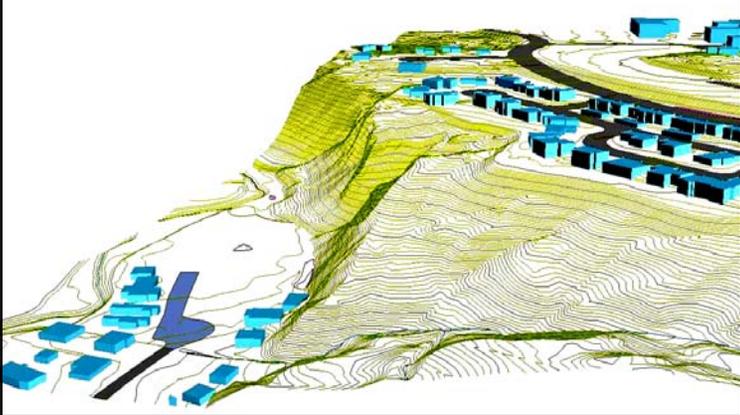


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11

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## Simple Building Outline 2D Polygon with Elevation Attribute



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## 3D Building Outline "Block Style" SANBORN

Multiple 2D polygons with elevation attribute

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## 3D Building Models (True Architecture): SANBORN

Stereo Image Compiled

© 2006, The Sanborn Map Company, Inc. Privileged and confidential information. Distribution or copying prohibited unless approved in writing. Three-dimensional digital elevation model. New York City, New York

## Building Model Textures SANBORN

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## Editing and Processing for Polygons SANBORN

(QA/QC)

Automated Topology Vector Checks

- Edgematching
- Point duplication
- Connectivity
- Line quality
- Segmentation
- Point criteria
- Precision
- Line criteria
- Spatial continuity
- Graphic standards

Other QA/QC Checks

- Attribute domains
- Symbology
- Annotation criteria

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## Building Classification: Photo Identifiable

- Single-Family Building (Residential), Multi-Family Building (Residential)
- Commercial: Building devoted to trade, services, entertainment, cemeteries, and recreational
- Industrial: Building devoted to warehouse, manufacturing, processing, or miscellaneous industrial activity
- Institutional Building: devoted to civic or educational activity
- Mixed Use
- Utility Structures: devoted to transportation, utility or facility housing.
- Mobile Home, Detached Carport, Detached Garage, Out Building
- Tank Canopy (Gas Stations, Banks, RTD Stations)
- Parking Garage (Commercial), Recreational (Parks, Golf Courses)
- Cemetery, Entertainment (Amusement Park, The Coliseum)
- Catwalk or Building Connector, Corridor, Shed, Greenhouse, Under Construction, Uninhabitable, Destroyed, or Demolished, Miscellaneous Structure, Enclosed Courtyard, Non-Building
- Miscellaneous Structures: devoted to an unknown or other use

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## Building Attribution

- Object/building id
- Sq. footage (photo identifiable)
- Height of buildings (photo identifiable)
- Number of floors (Derived based upon height)
- Database linkage possibilities
  - Address(es) (linkage to existing geocoded database)
  - APN association with DSO4 attributes table
  - Name of building (City Hall, Museum, Culture Center, etc.)
  - Hazard building
  - Prevailing use (based on classification of buildings)
  - Fire zone
  - Emergency use

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## Building Attribution: Database Linkage Issues

- Issues related with adding attributes
  - adding addresses based on integrated processing County address files
  - solving discrepancies among files
  - one building on many parcels
  - multiple buildings on one parcel
  - legacy addresses not following County rules
  - fragmental addresses (for example: 24 ¼)
  - development of various classifications

Cooperation with a local firm and County to solve these issues

- This will add some additional costs for the project

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## Recommendations

- Stereo digitizing is more accurate for above ground features (buildings) due to radial displacement (lean)
- Stereo digitizing allows for elevation attribution
- Stereo digitizing allows for True 3D format
- Stereo digitizing allows for a greater percentage of features captured due to hidden areas (caused by building lean)
- Establish Pilot area for ~10,000 buildings to create accurate scope and cost.
- Additional value of base products, Ortho and Oblique imagery can be used by the County or outside vendor to complete quality assessment.



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# Questions?

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