Improving Safety and Efficiency in Transportation Planning
(And some Photogrammetry)
Why are we here?:

What technologies are ready to be adapted by the planning community?

Where we are with use of drones
333, part 107

Different services that could benefit from use of drones

Specific examples (parking inventory study, planning operations honda parkway)
Why are we here?:

What technologies are ready to be adapted by the planning community?

Drones
Why are we here?:

How can drones solve problems in within the planning community?

How will drones solve YOUR specific problems.
About

- Columbus, OH software company
- Cloud-based photogrammetry software (drone software)
- **Expertise in software solutions that scale**
- Currently serving surveying, civil engineering, construction, etc
Why Drones UAS?
What is a UAS?

Unmanned Aerial System (UAS)
- Not R/C model aircraft
Flies autonomously (without external control)
  - GPS
  - IMU
  - Compass
  - Micro computer

OR
UAS Data Collection

New way to collect 3D Data

Quick, accurate, affordable

High Resolution 3D Data

*The new GPS?*
Efficiency + Safety?

- How much 3D data do you collect in the planning stage?
- Are there instances where you may not be safe while working?
What should you get?
Drones

1. DJI
2. Sensefly
3. Trimble
4. 3DR
5. Parrot
6. Aeryon
7. Etc
Multi-Rotor

- Less Endurance
- VTOL capability
- Variable speed speed
- Easily Maneuverable
Fixed-Wing

- Longer Endurance
- No VTOL capability
- Maintains a cruising speed
- Wear and Tear on body
Photogrammetry: Then and Now
Tiepoints

3D Surface

Known X, Y, Z

Unknown X, Y, Z

Known X, Y, Z

Nine tie points in each image tie the block together

Tie points

The world in 3D - UMAP Technologies
Stereoplotters

1. Object is stationary
2. Camera is moving
3. Overlap between images
4. Scale (e.g. GNSS)

Image credit - Alnozom
1. No more heavy equipment training
2. Use existing workstation
3. Still manually intensive
4. Need to wear those funny 3D glasses

Image credit - Cardinal Systems
Multi-View Stereo

1. Object is stationary
2. Camera is moving
3. Overlap between images
4. Scale (e.g. GNSS)

Image credit - Clemson University
Tiepoints

3D Surface

All Tie Point Extraction Is Fully Automated!
Transportation Case Study
West Jefferson Intersection

What is the accuracy of drone based measurement vs. conventional surveying techniques?
West Jefferson Intersection/
Component Images
Component Images

Moving vehicles in and out of frame
Point Cloud
Point Cloud
Point Cloud
Component Images

Edges of curb are smoothed out from raw point cloud
Benefits of Drone Collection

A picture is worth a thousand words - or a thousand dollars?
Conventional Survey vs Drone Capture
Georeferencing
(Ground Control)
Ground Control

Targets in the image that are observed with high accuracy

X, Y, Z
dX, dY, dZ

Estimated Surface

True Surface (w/ GCPs)
**Ground Control**

**Good** - Pixel measurements are incorporated into the Bundle Adjustment

**Bad** - Point cloud is fit to the ground control points

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- $X, Y, Z$
- $dX, dY, dZ$
- **Estimated Surface**
- **True Surface (w/ GCPs)**
Ground Control

“Bowing Effect”

- Transmission Line
- Ground Control Points are the “Posts”

True Surface (w/ GCPs)

Estimated Surface

“Bow Effect” (Poor Camera/Lens)

X, Y, Z
dX, dY, dZ
Ground Control

"Bowing Effect"

You CANNOT and SHOULD NOT solely use “On-The-Fly” Self-Calibration
Conclusion