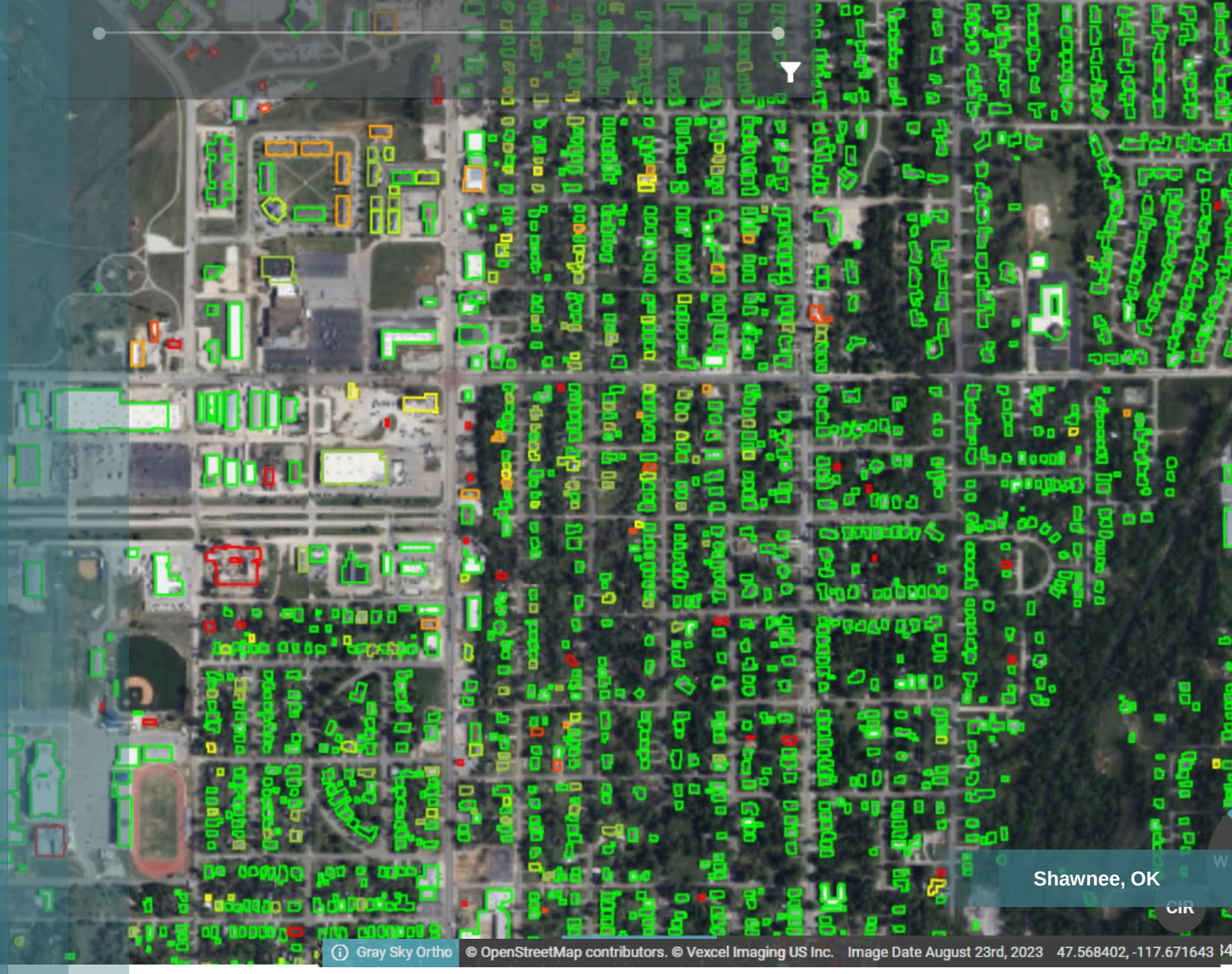
VEXCEL
DATA PROGRAM

A Race to Answers: AI/ML based insights using high resolution aerial data

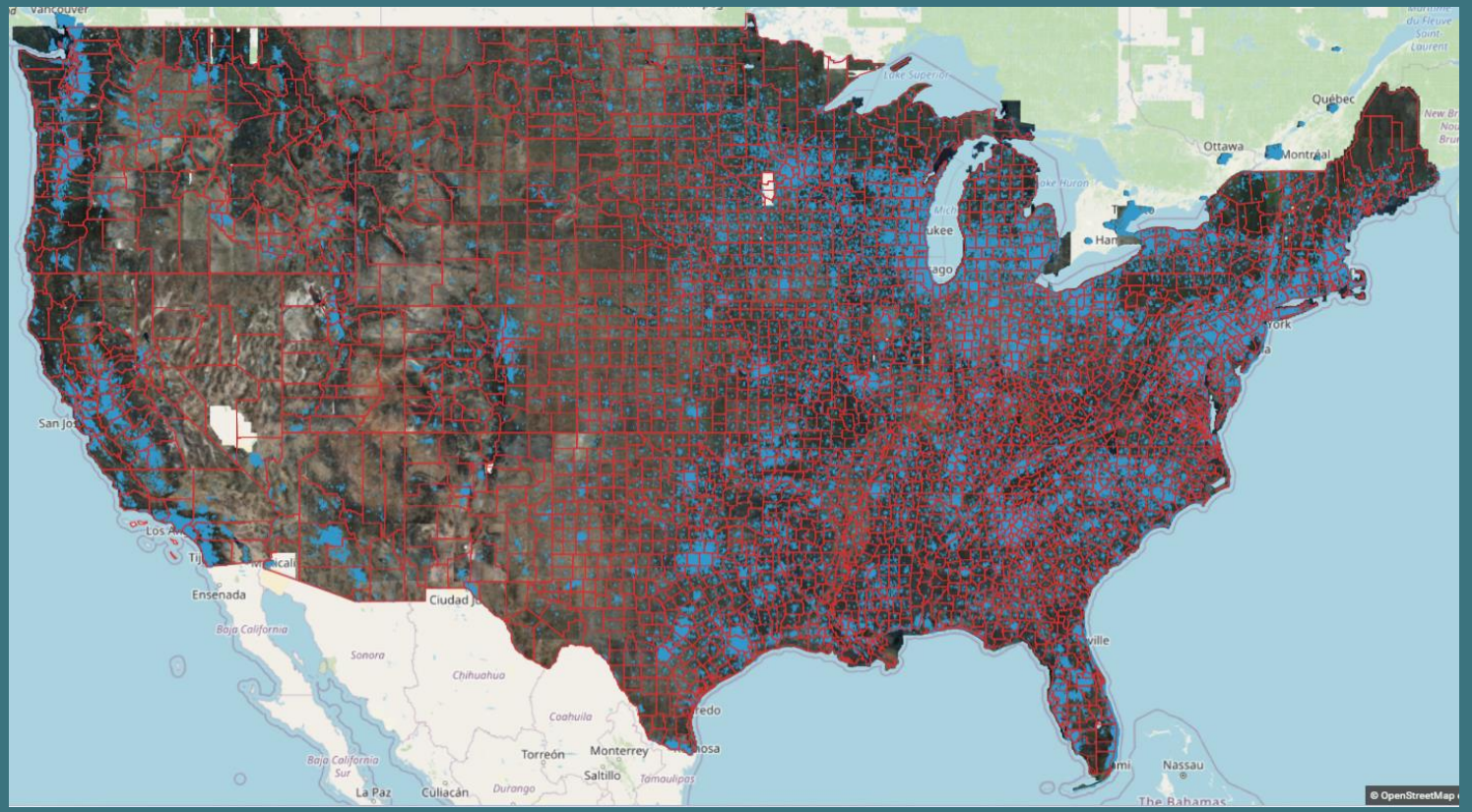
Texas GIS Forum

Brian Garcia
Business Development Manager
Vexcel Government Solutions



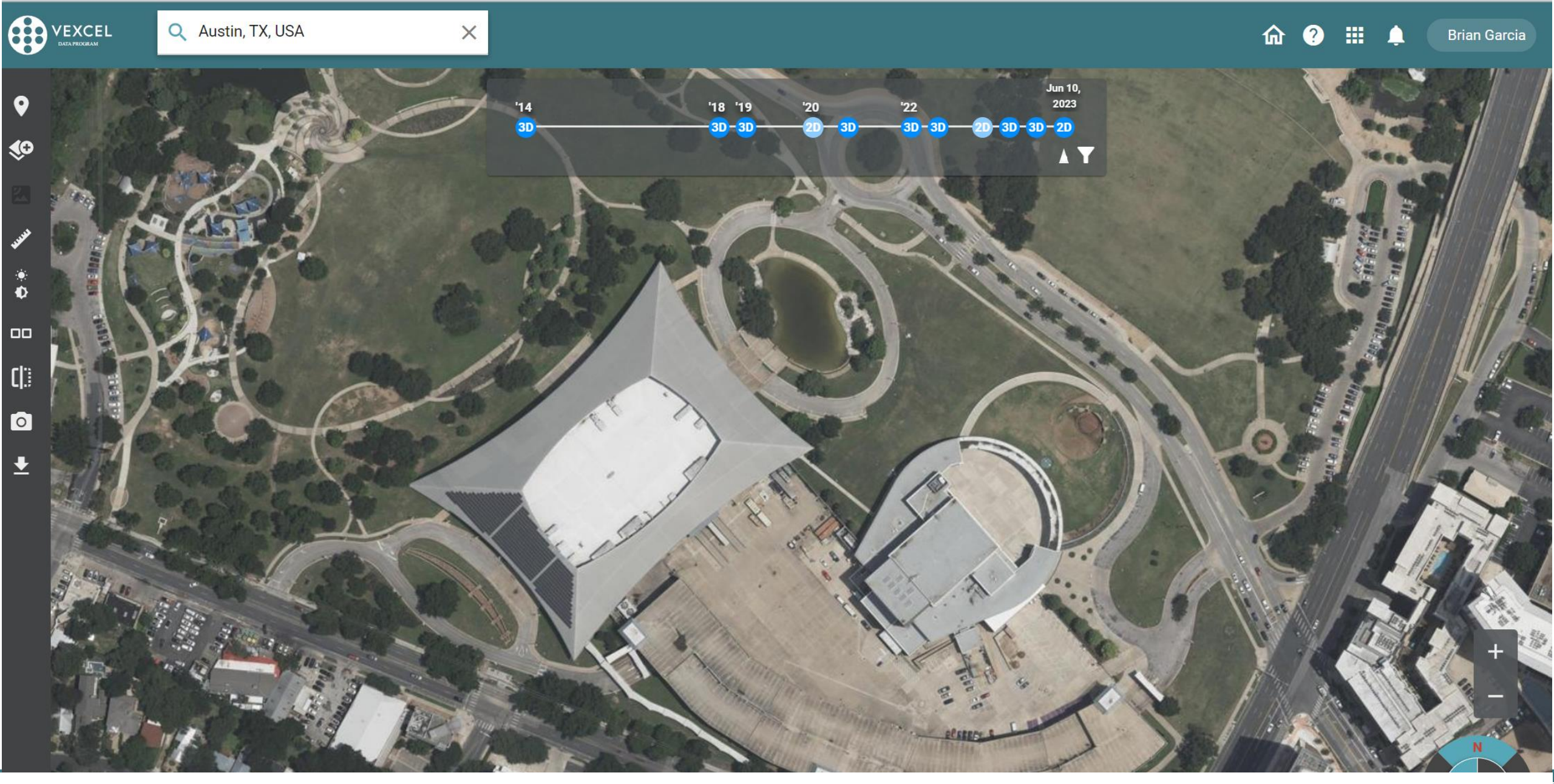
Data Needs and Challenges

- Geographic scale of parcels
- Timeliness/Cost of data collection
- Keeping records up-to-date
- Accuracy
- Reactive / Proactive information
- Compliance assurance
- Extracting insights & priorities

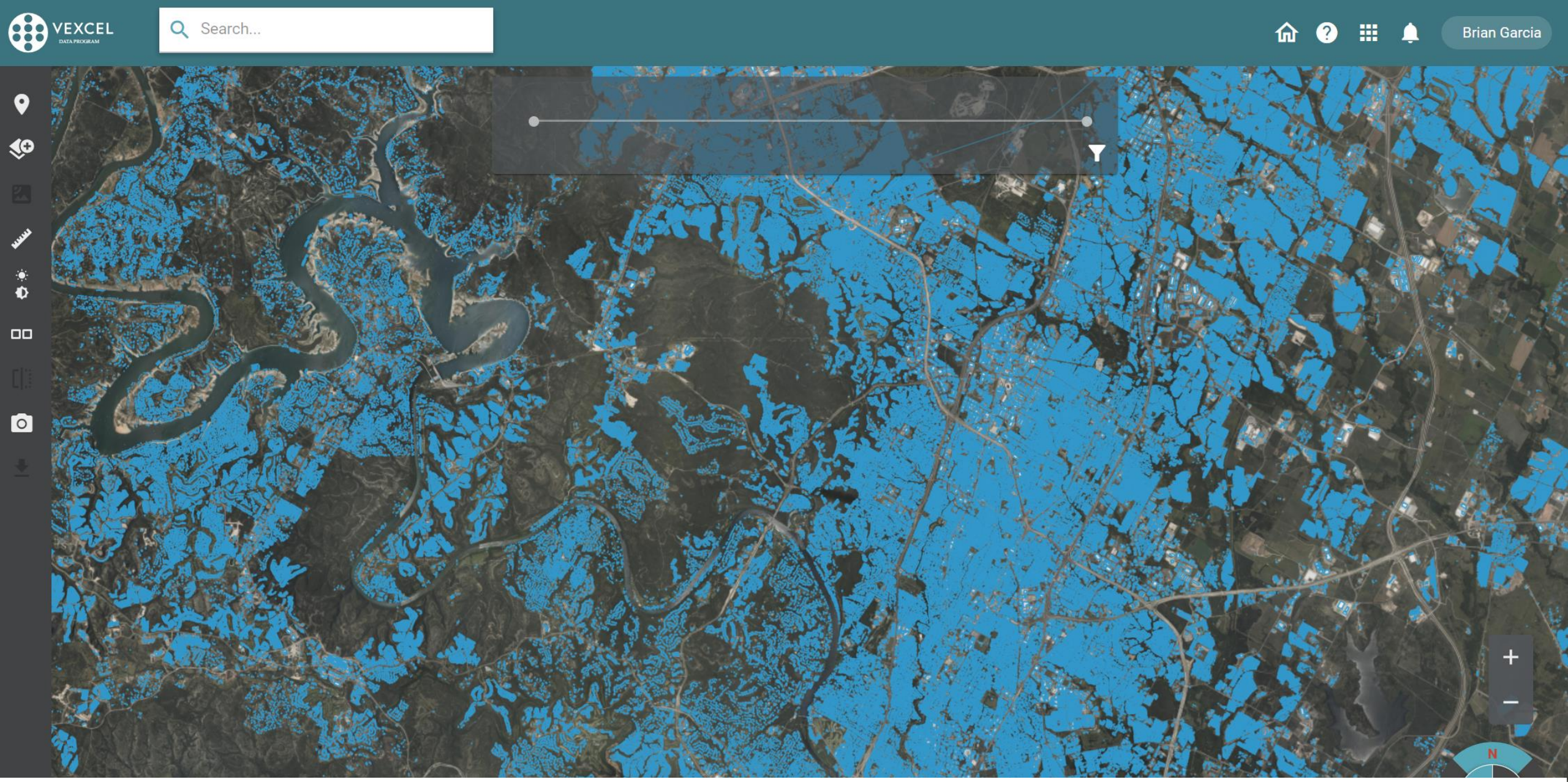


Expanding Data Options & Insights – No "Silver Bullet"

	Coverage & Refresh Rate	Positional Accuracy & Ground Truthing	Data Repeatibilty; Consistent Quality	Low Cost per Mile	
Satellite Imagery	7	1	4	7	Good for broad roadway network overview info
Aerial Mapping	6	6	6	5	Expanding use of AI/ML on high resolution imagery for inventories, conditions, safety
Mobile Mapping	2	7	7	1	Ideal for engineering survey
Photologging	3	5	5	3	Good for historical records, and specific area recall
Fleet & Dashcam Data	4	3	3	4	Growing uses for street level AI/ML insights
OEM Connected Vehicle Data	5	2	2	6	Good crowdsourced telematics info for driver behaviors & safety
Manual Field Collection	1	4	1	2	Traditional approach for project specific data collections per a user spec



Growing Utilization of High-Resolution Imagery & Analytics

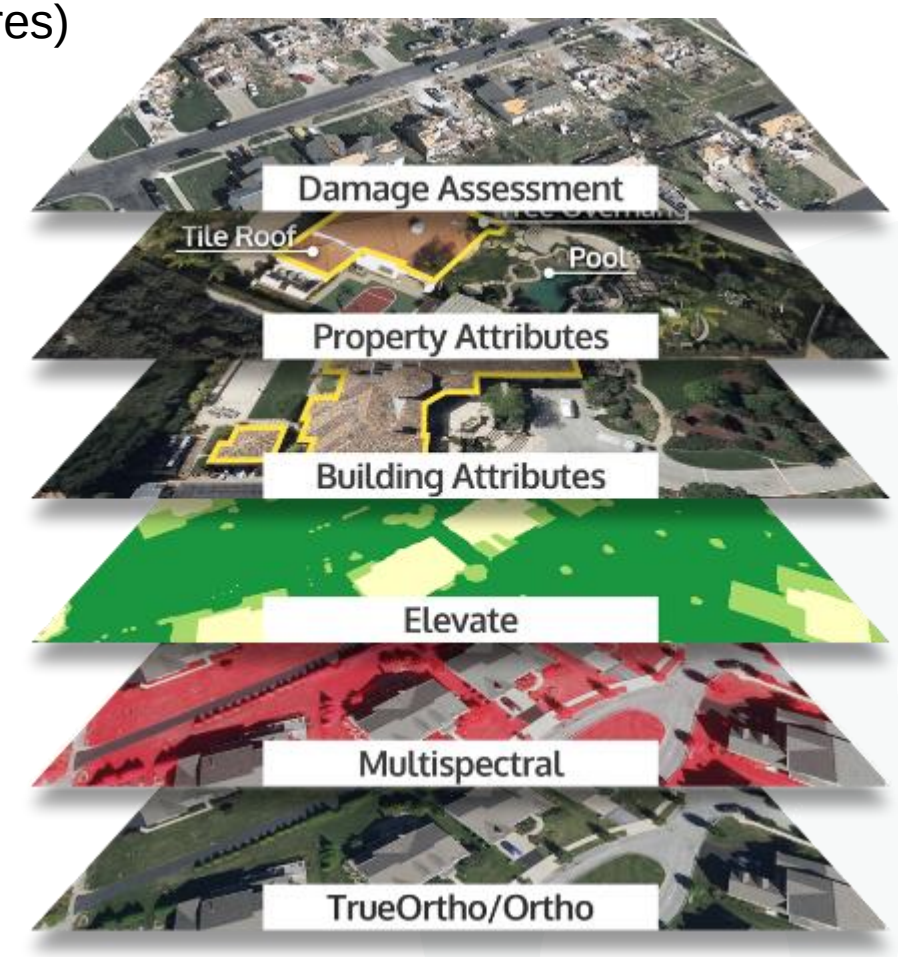


Imagine if you could prioritize top issues across your entire County

About Vexcel

30 years of photogrammetric excellence
Aerial content across 30 countries
Data histories back to 2016
Growing AI/ML library (w/80+ features)

Vexcel Data Program



Vexcel Fleet

Vexcel Imaging

About Vexcel

Data Collection and Coverage

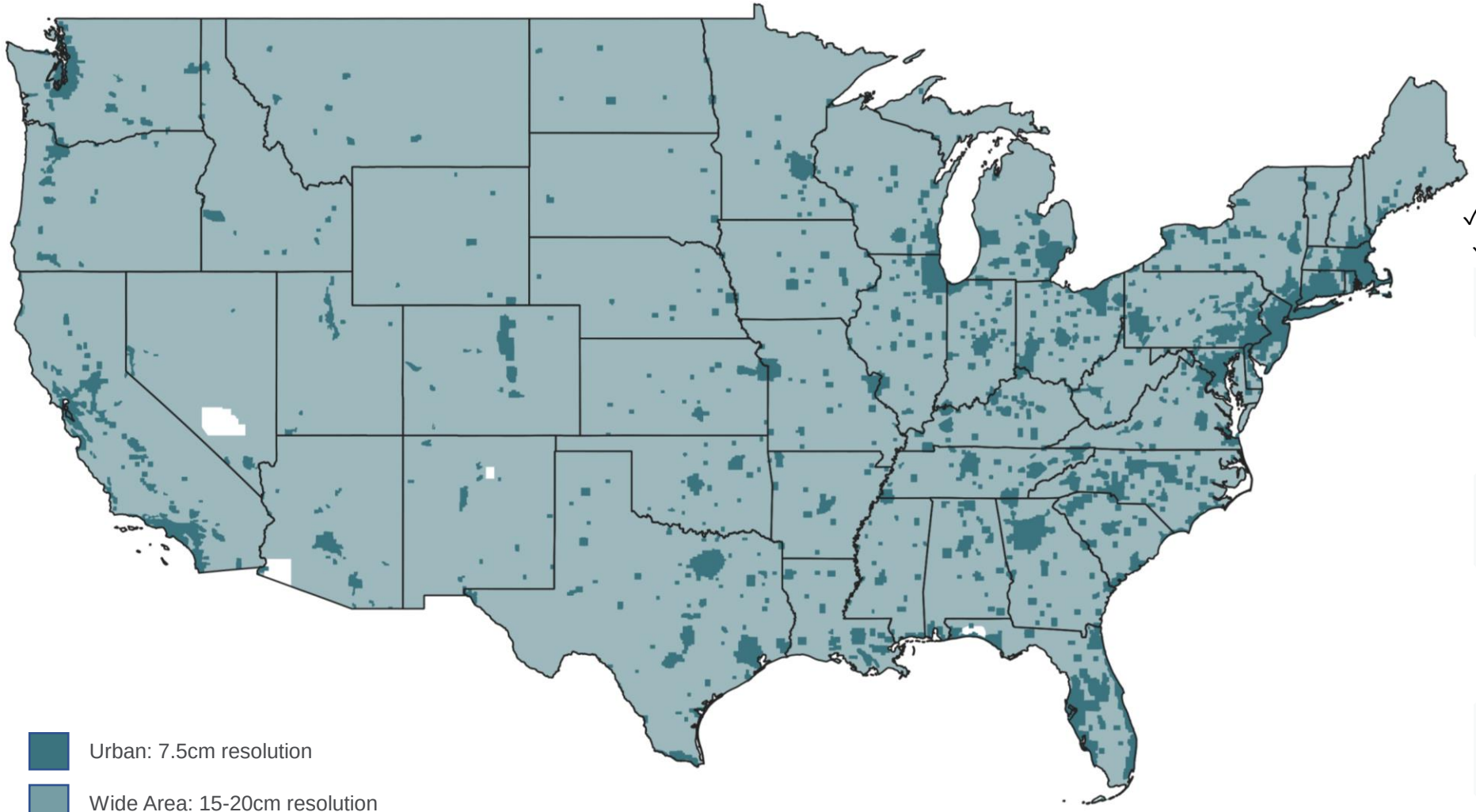
Uses Cases

- Property Assessment
- Emergency Management
- Roadway Assessment

Analytics and Change Detection

Hollywood, FL

Existing U.S. Footprint: 3 million sq mi



Urban: 7.5cm resolution

Wide Area: 15-20cm resolution

Largest collection of its kind with:

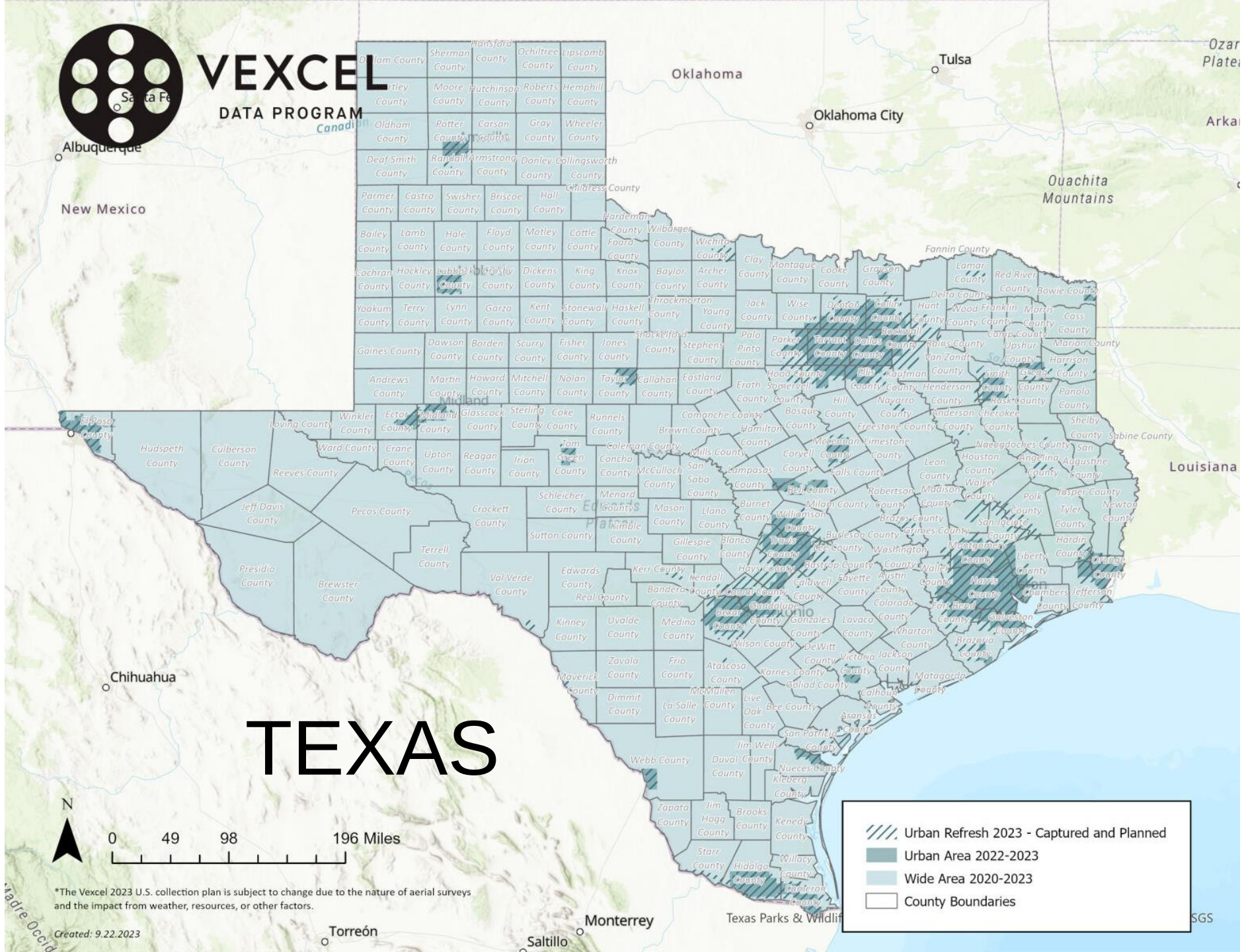
✓ Unmatched accuracy
✓ High-resolution aerial imagery
✓ Consistency across imagery

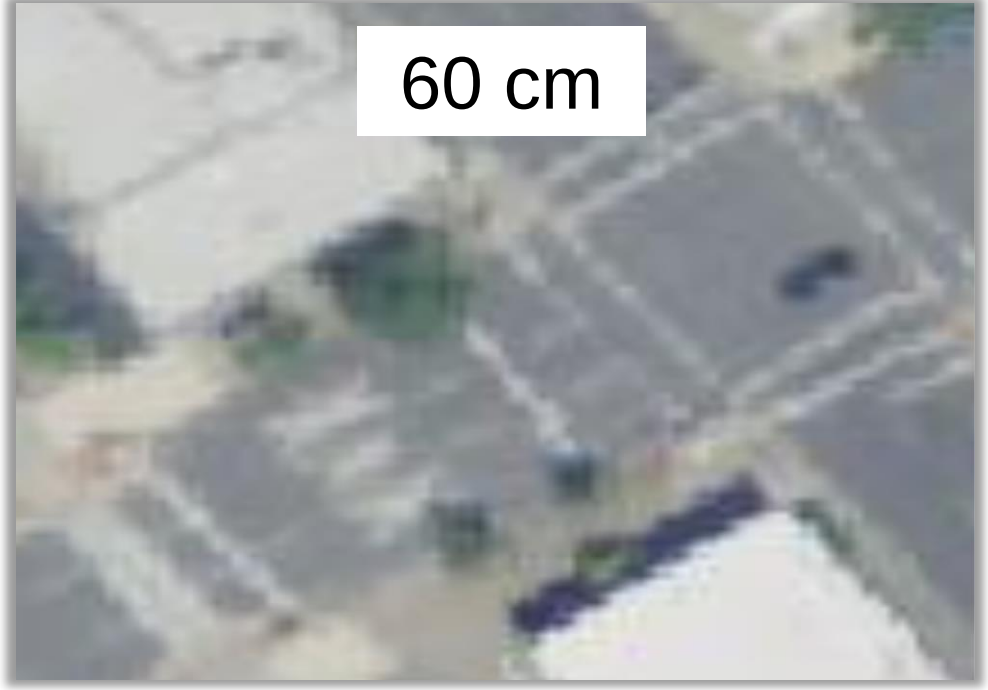
49 states

Urban & rural collections

99.6% U.S. population

127 million U.S. households


VEXCEL
DATA PROGRAM
TEXAS
Urban Refresh 2023 - Captured and Planned
Urban Area 2022-2023
Wide Area 2020-2023
County Boundaries
N
0 49 98 196 Miles
*The Vexcel 2023 U.S. collection plan is subject to change due to the nature of aerial surveys and the impact from weather, resources, or other factors.
Created: 9.22.2023
Oklahoma
Tulsa
Oklahoma City
New Mexico
Albuquerque
Louisiana
Chihuahua
Monterrey
Torreón
Saltillo


60 cm

30 cm

15 cm

7.5 cm

Orthomosaic Imagery Products

TrueOrtho

- No building lean or seamlines; color balanced; top-down
- Urban area collection
- Insight for rooftops and property surroundings
- 7.5cm resolution

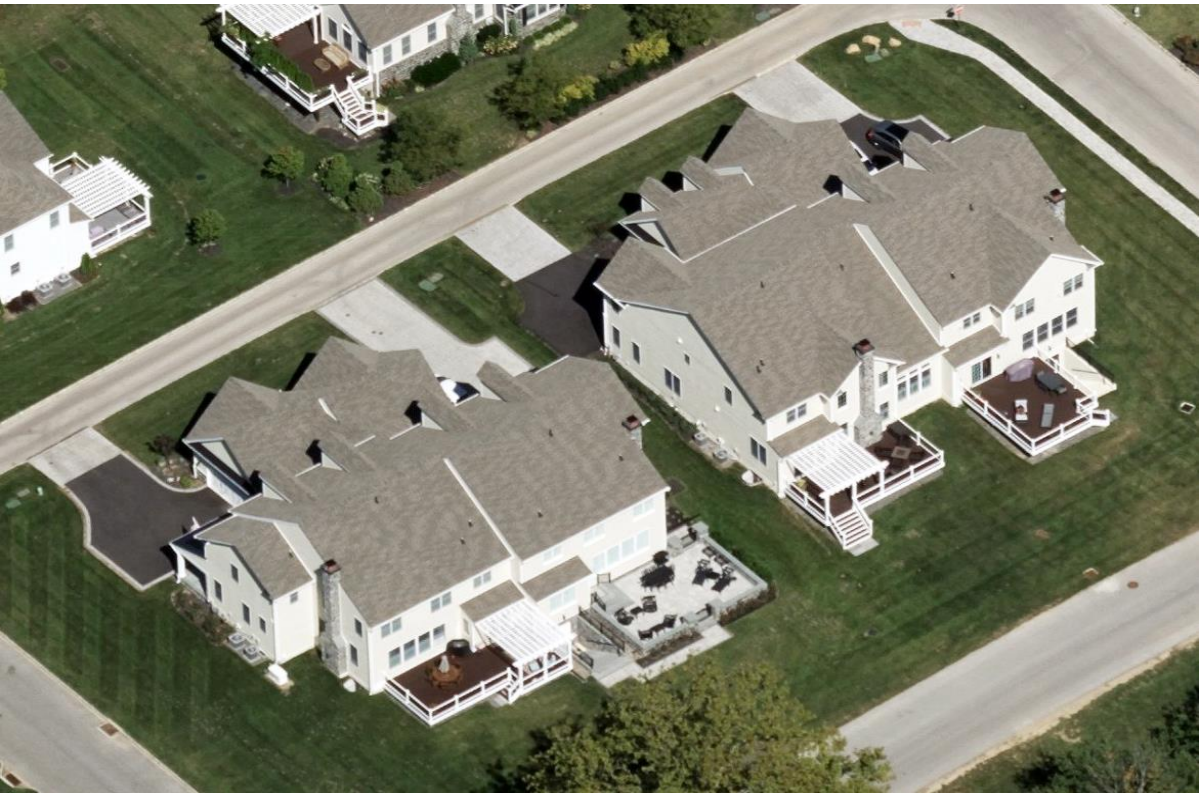
Urban Ortho

- Straight-down aerial view
- Urban area collection
- Increased frequency, greater currency in U.S. urban areas
- 7.5cm resolution

Wide Area Ortho

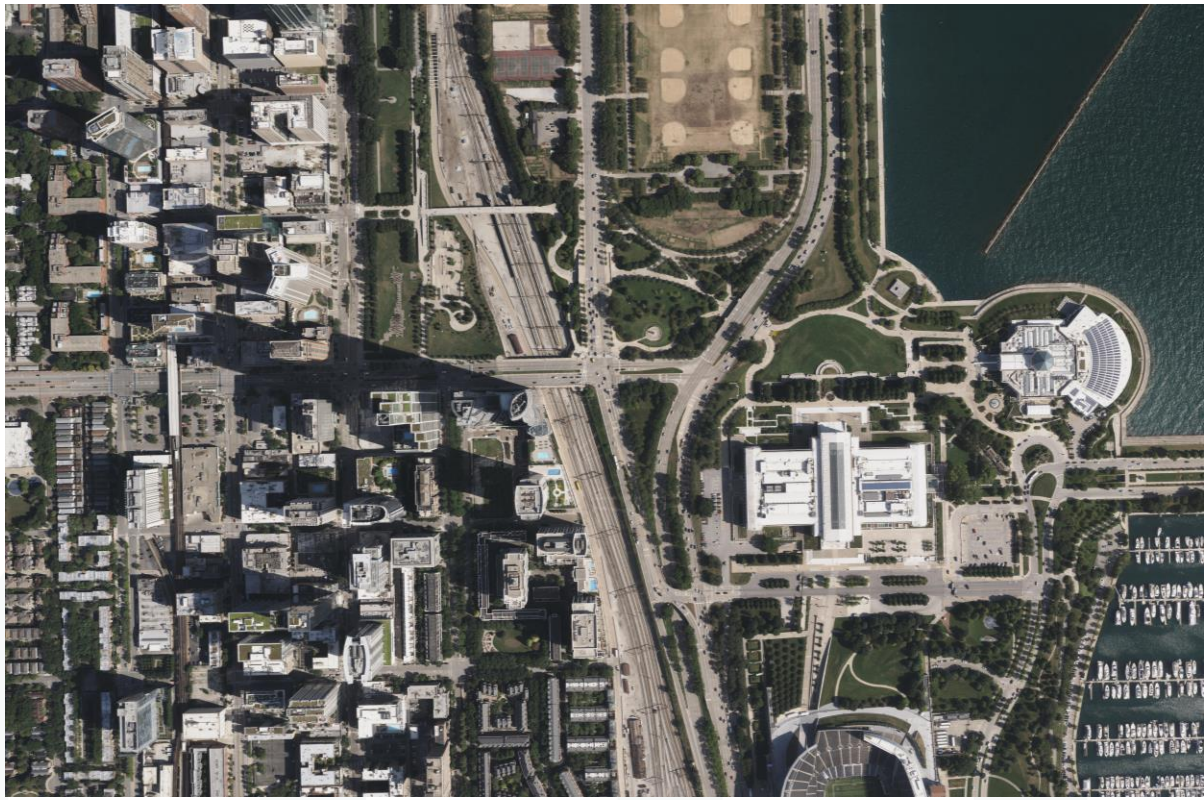
- Straight-down aerial view of buildings, parcels, and farmlands
- Urban and rural collection
- Insight for rooftops and property surroundings
- 15-20 cm resolution

Oriented Imagery Products



Oblique

- Collected at a 45° perspective
- Detailed views—north, south, east, west—of properties, neighborhoods, buildings
- 7.5cm resolution



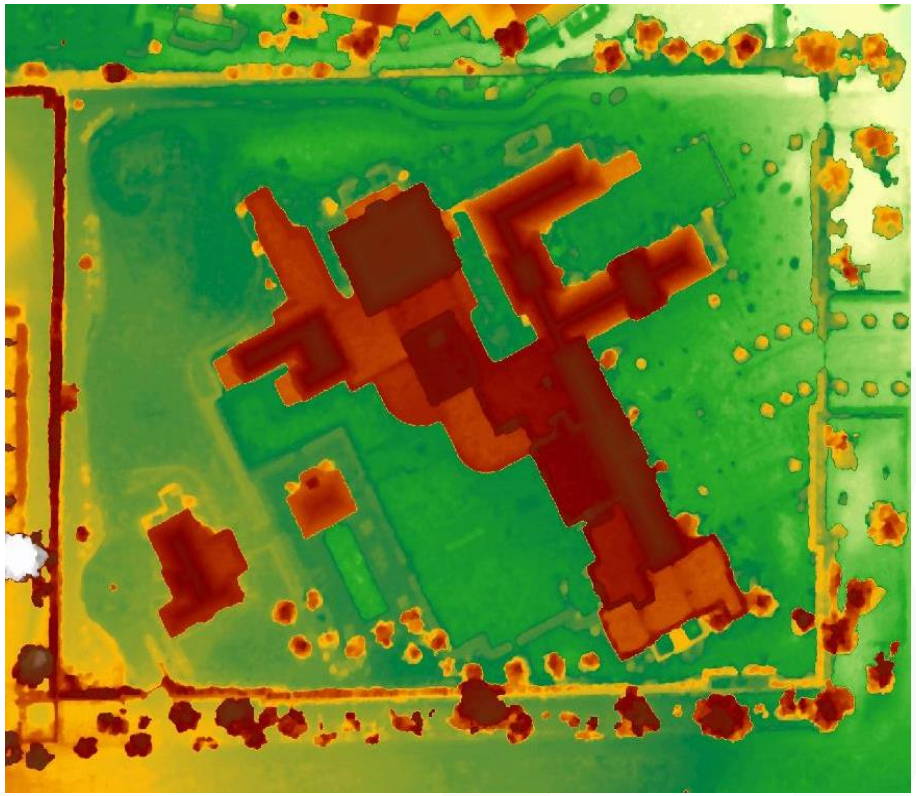
Nadir

- Top-down oriented images
- AI/ML applications
- 7.5-20cm resolution

Aerial Imagery & Data

Multispectral

- Near-infrared channel on camera sensors
- Optimal for classification on vegetation and fire risk
- Wide and Urban Area collection programs

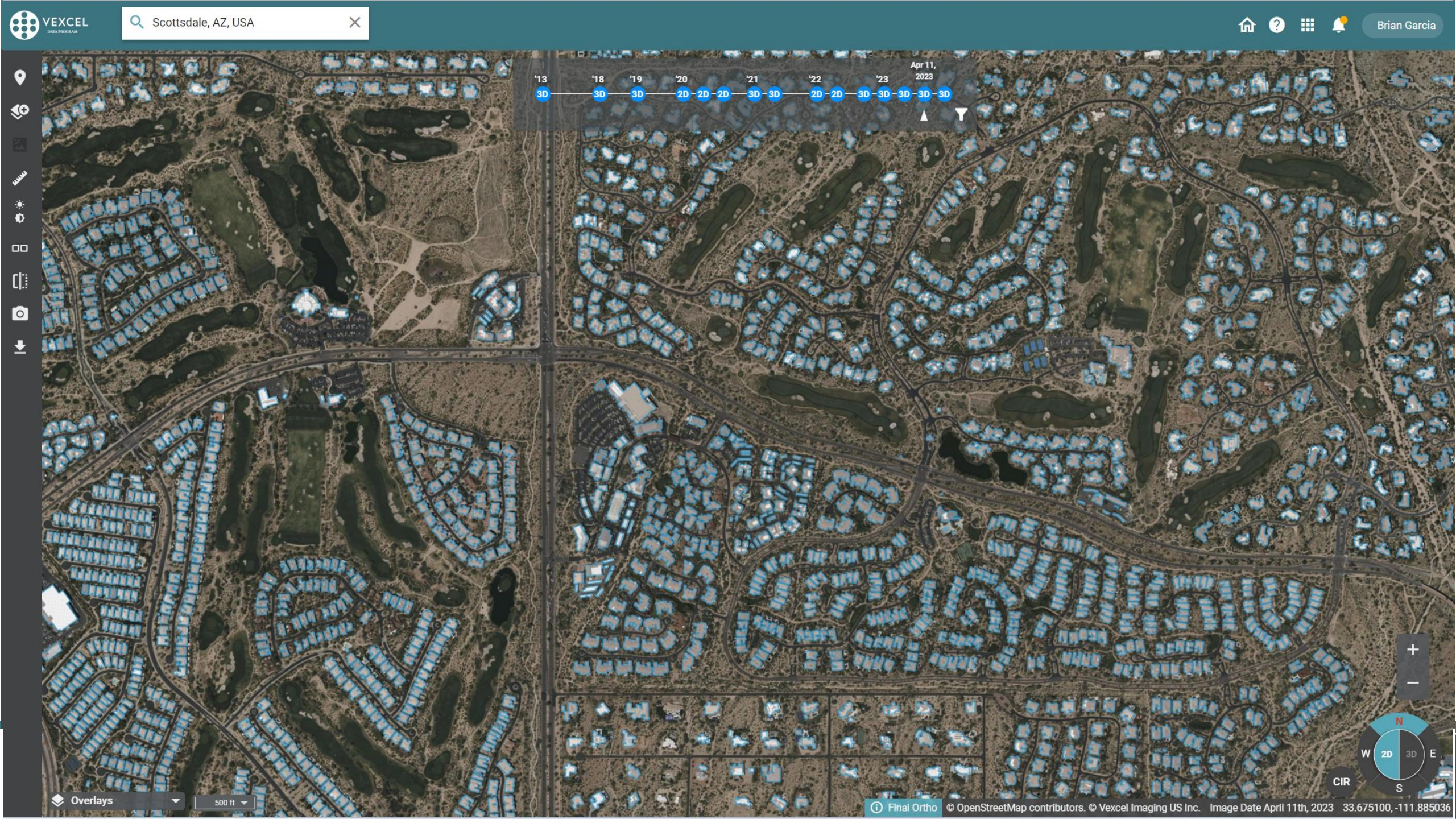


Elevate

- Digital Surface Models (DSM)
  - Urban and Wide Area collection programs
- Digital Terrain Models (DTM)
  - Wide Area collection programs

Disaster (Gray Sky)

- Natural disaster collection program
- Imagery delivered typically within 24 hours after capture
- Before/after comparisons


VEXCEL
Scottsdale, AZ, USA
Brian Garcia
'13 '18 '19 '20 '21 '22 '23 Apr 11, 2023
3D 3D 3D 2D 2D 2D 3D 3D 2D 2D 3D 3D 3D 3D 3D
Overlays
500 ft
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CIR
Final Ortho
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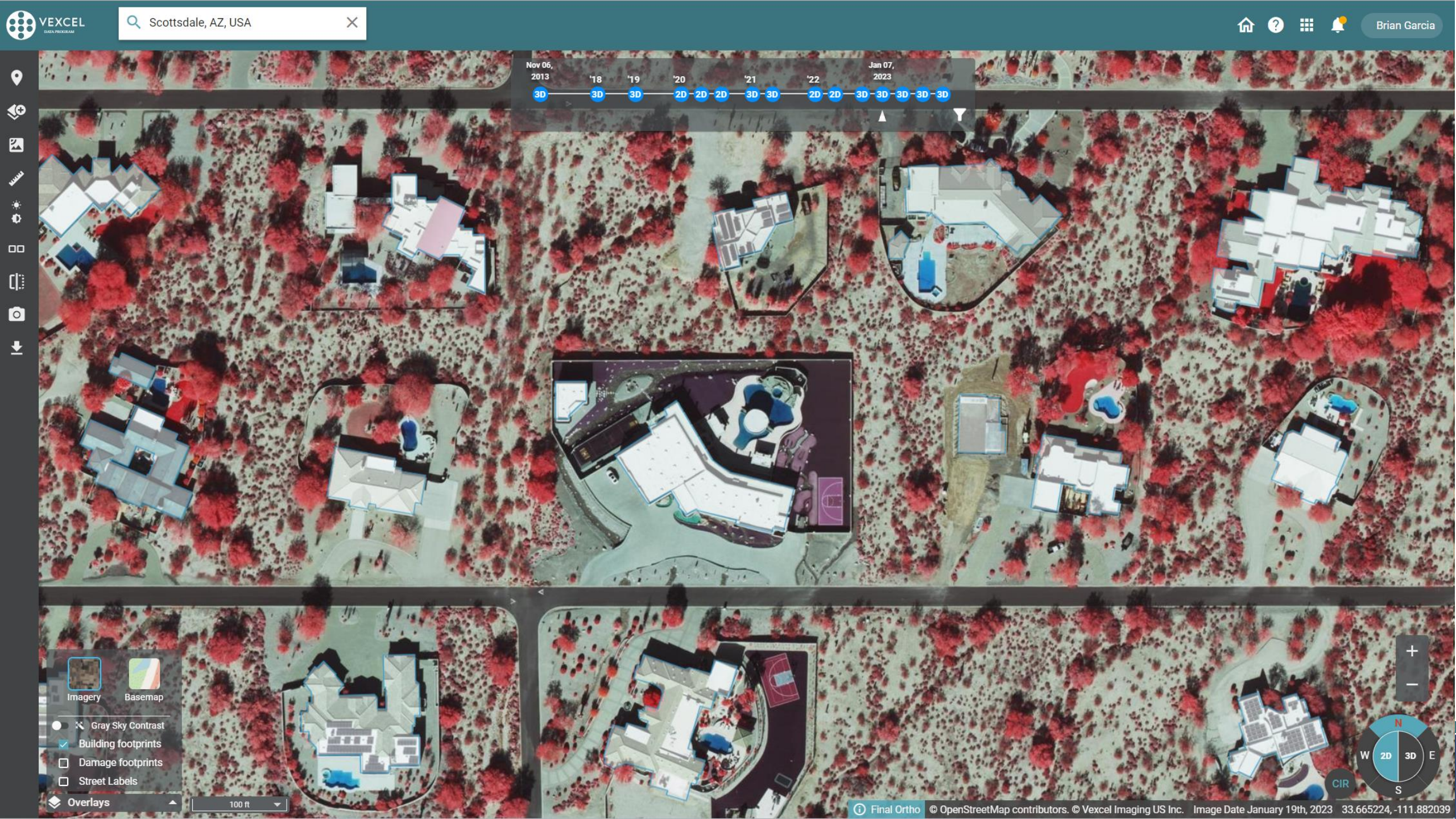
Image Date April 11th, 2023
33.675100, -111.885036


VEXCEL
Scottsdale, AZ, USA
Brian Garcia
Nov 06, 2013
'18
'19
'20
'21
'22
Jan 07, 2023
3D 3D 3D 2D 2D 2D 3D 3D 2D 2D 3D 3D 3D 3D 3D
Imagery
Basemap
Gray Sky Contrast
Building footprints
Damage footprints
Street Labels
Overlays
100 ft
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3D
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CIR
Final Ortho
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Image Date January 19th, 2023
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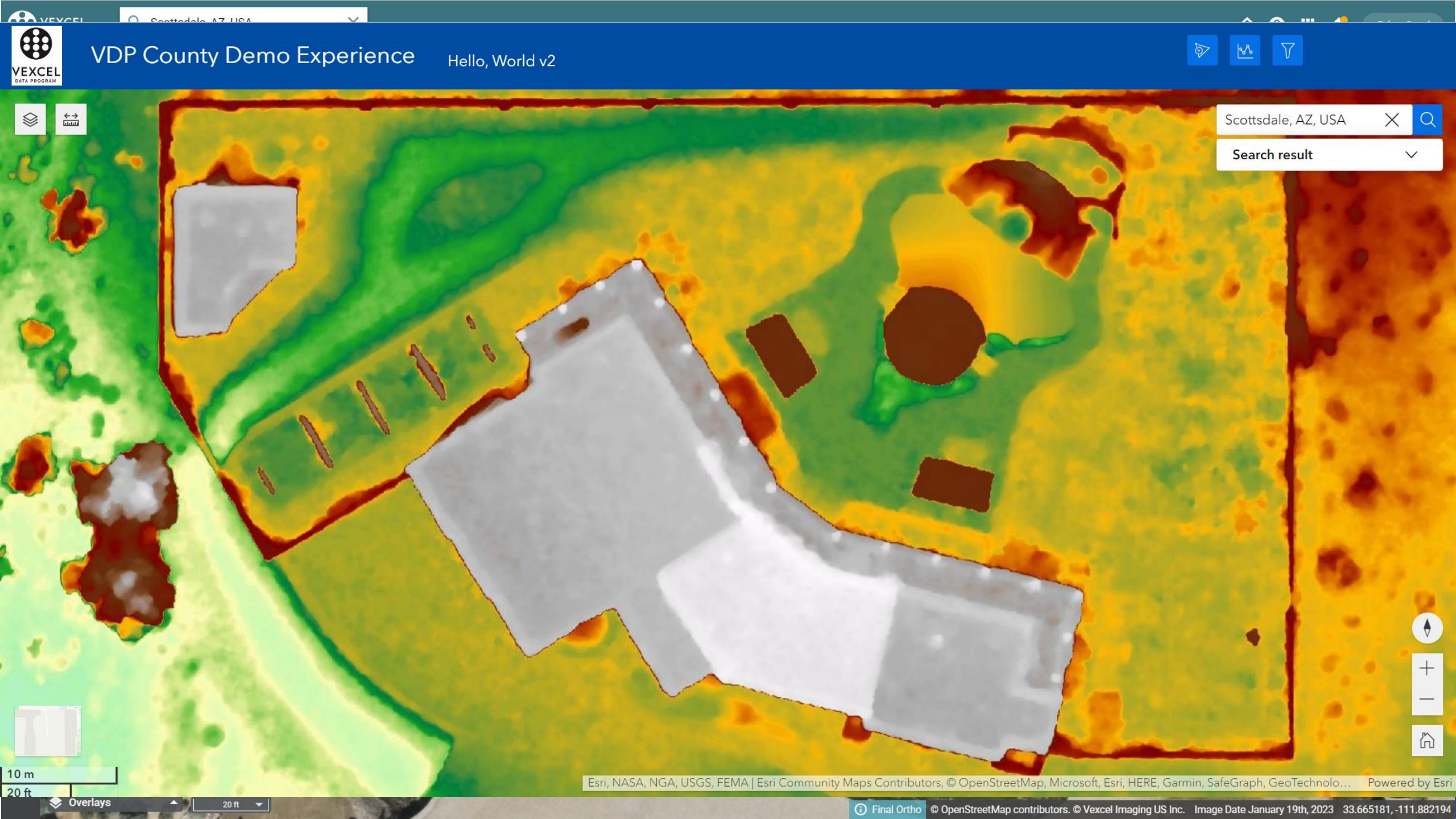
VEXCEL DATA PROGRAM
VDP County Demo Experience
Hello, World v2
Scottsdale, AZ, USA
Search result
10 m
20 ft
Overlays
20 ft
Esri, NASA, NGA, USGS, FEMA | Esri Community Maps Contributors, © OpenStreetMap, Microsoft, Esri, HERE, Garmin, SafeGraph, GeoTechnolo…
Powered by Esri
Final Ortho
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Image Date January 19th, 2023
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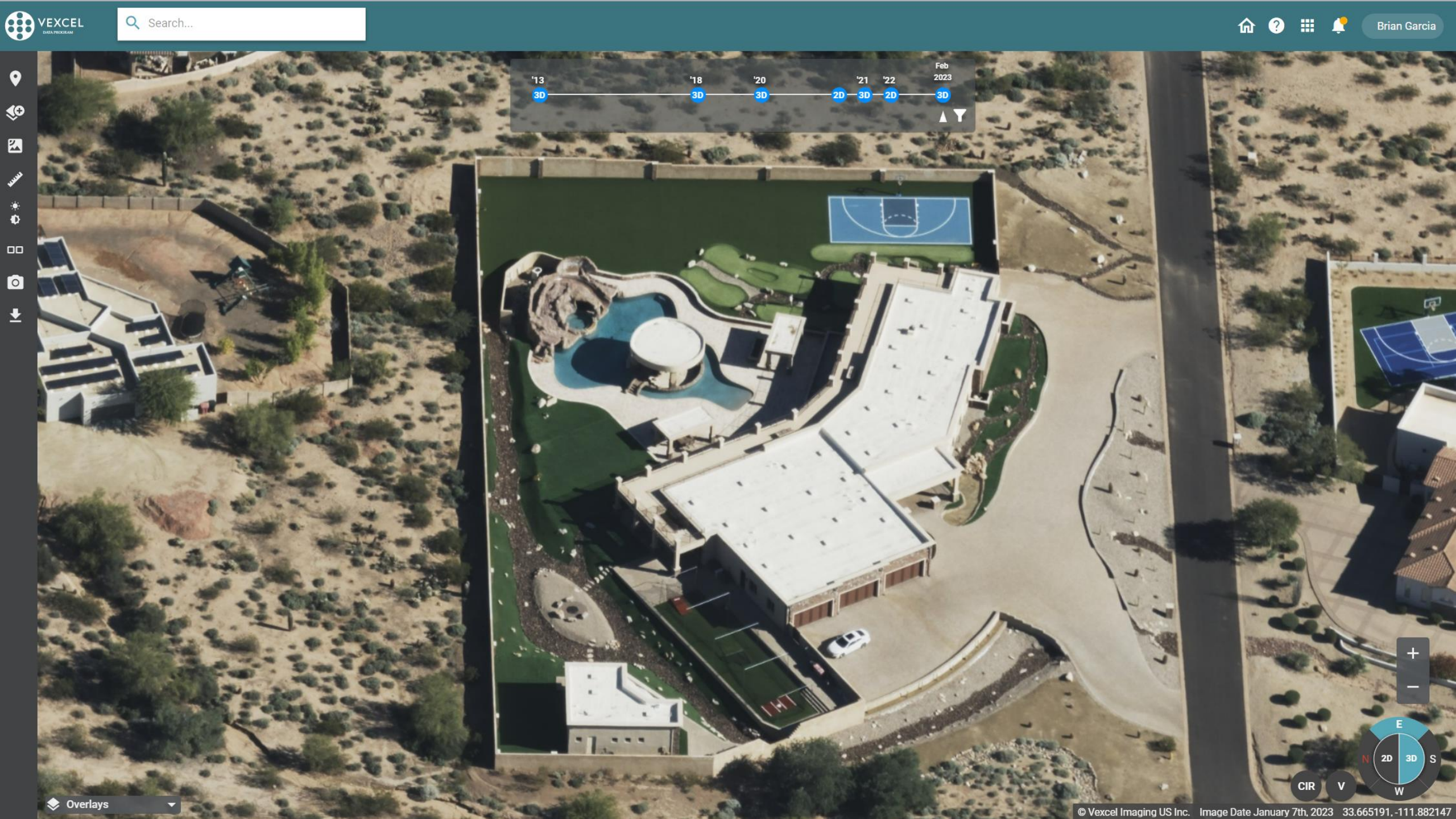
VEXCEL
DATA PROGRAM
Search...
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© Vexcel Imaging US Inc.
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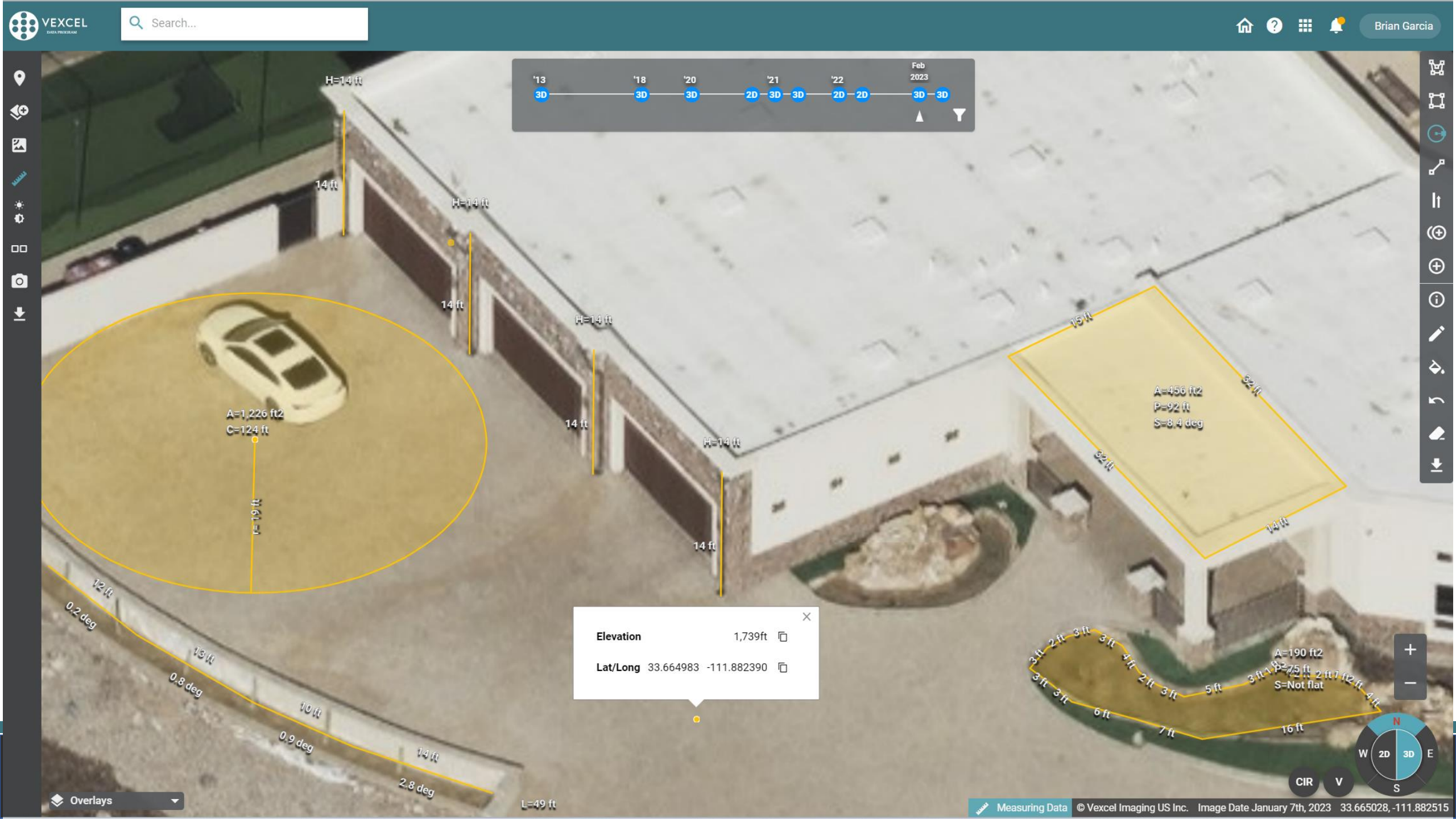
VEXCEL
Search...
Brian Garcia
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'18 3D
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'21 2D 3D 3D
'22 2D 2D
Feb 2023 3D 3D
H=14 ft
14 ft
H=14 ft
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A=1,226 ft2
C=124 ft
L=19 ft
15 ft
32 ft
A=456 ft2
P=92 ft
S=8.4 deg
32 ft
14 ft
12 ft
0.2 deg
13 ft
0.8 deg
10 ft
0.9 deg
14 ft
2.8 deg
L=49 ft
Elevation 1,739ft
Lat/Long 33.664983 -111.882390
A=190 ft2
P=75 ft
S=Not flat
16 ft
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Measuring Data
© Vexcel Imaging US Inc.
Image Date January 7th, 2023
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VEXCEL
Search...
Brian Garcia
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Final Ortho © OpenStreetMap contributors. © Vexcel Imaging US Inc. Image Date January 19th, 2023 33.665184, -111.882228
'13 Mar 02, 2018 '19 '20 '21 '22 '23
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Preview Ortho © OpenStreetMap contributors. © Vexcel Imaging US Inc. Image Date March 3rd, 2018 33.665207, -111.881130

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Search...
Brian Garcia
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3D 3D 3D 2D 2D 2D 3D 3D 2D 2D 3D 3D 3D 3D 3D
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3D
E
S
CIR
Final Ortho
© OpenStreetMap contributors. © Vexcel Imaging US Inc.
Image Date January 19th, 2023
33.665163, -111.882194

VEXCEL
Search...
Brian Garcia
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'22
Jun 10, 2023
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3D
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AI/ML based Insights - Building and Property Attributes
Austin, TX
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3D
E
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CIR
Overlays
500 ft
Final Ortho
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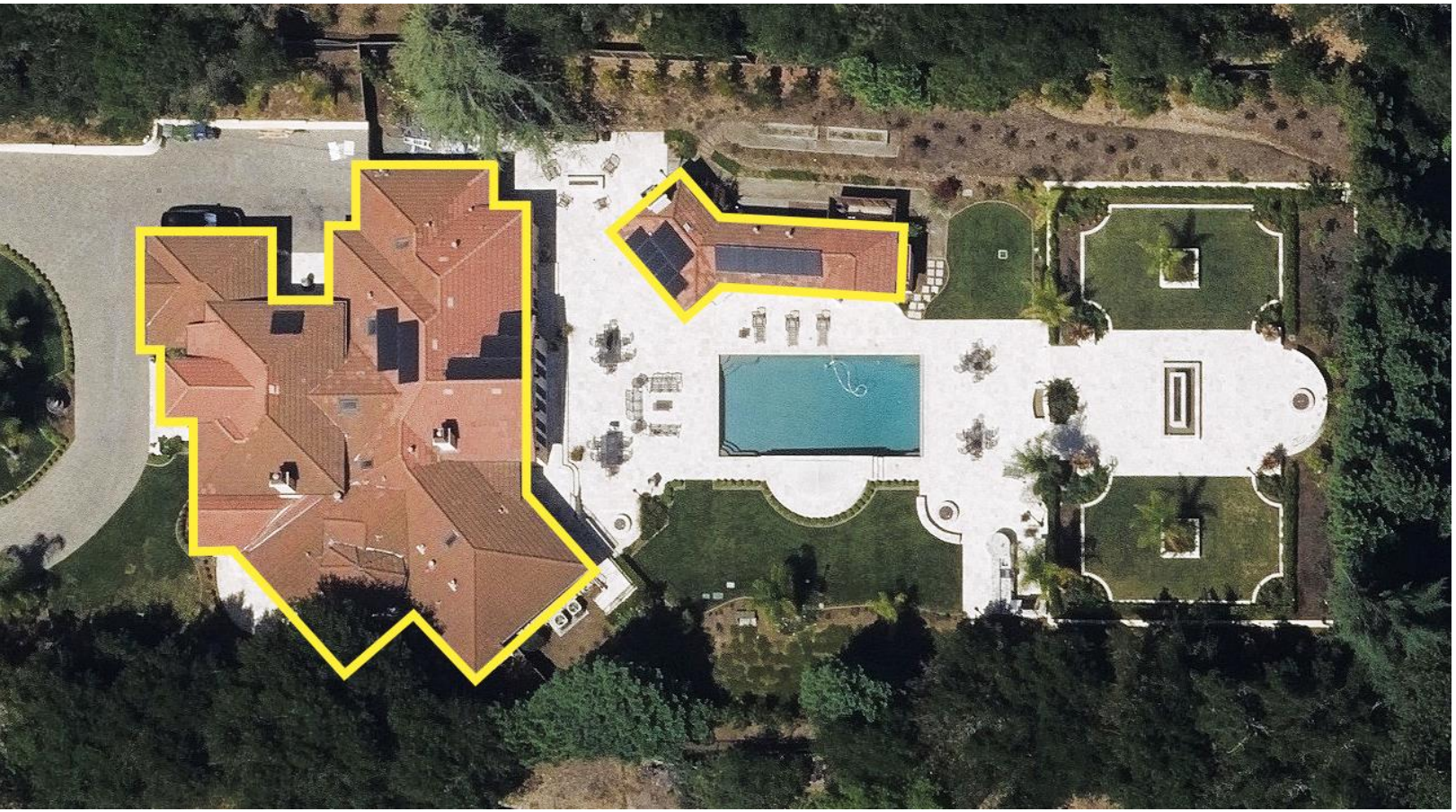
Image Date June 10th, 2023
30.407885, -97.916809

Building Elements

Access 40+ attributes for better, more precise property analysis



Building Footprints

- Geometry of building footprint

Building Attributes

- 20+ building and structure attributes
- Available for current and historical imagery

Property Attributes & Reports

- 20+ attributes for properties
- See footprint area, roof condition, solar panels, pools, hardscape information, and more
- Available for current and historical imagery

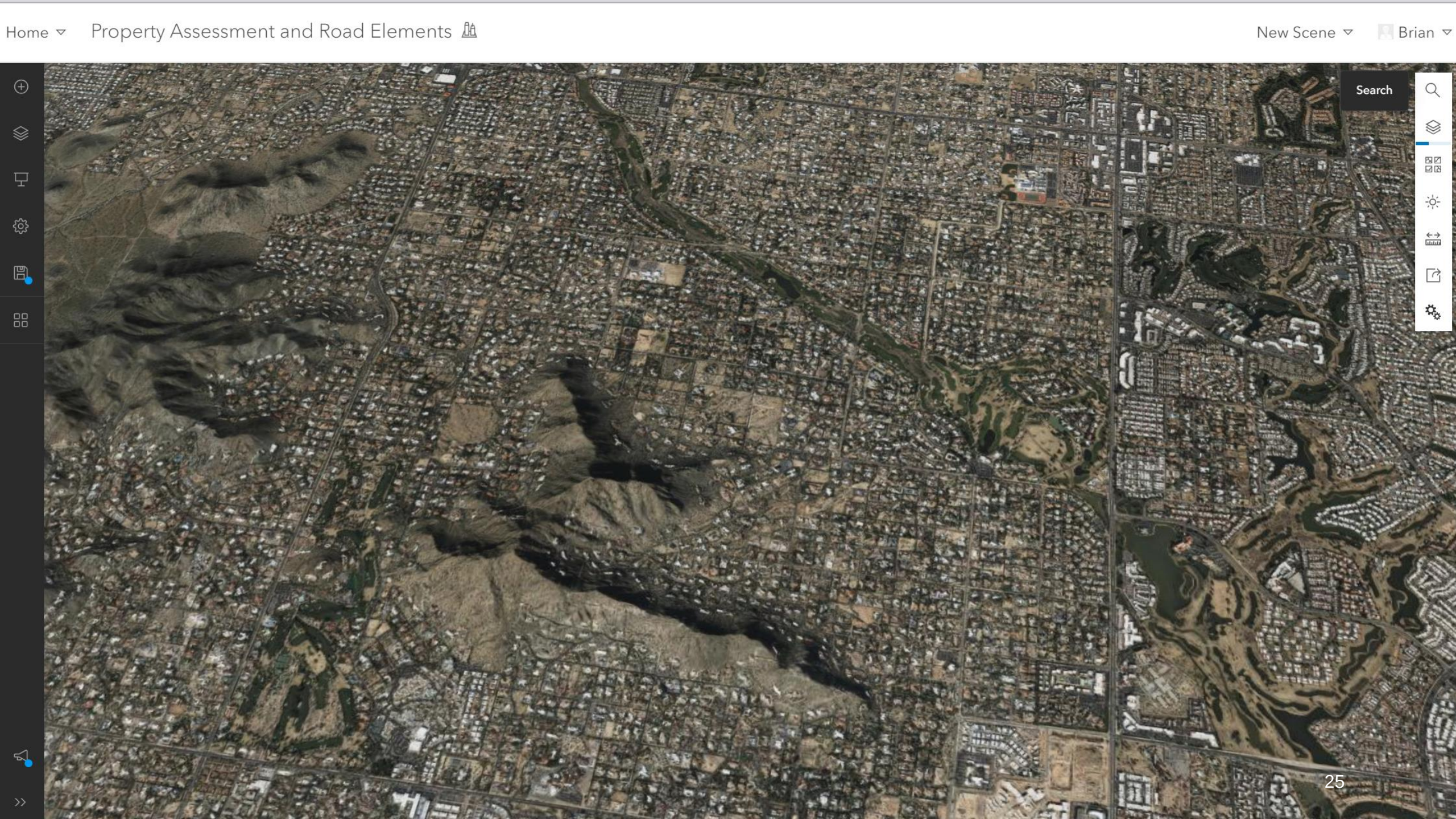
Damage Assessment & Reports

- Post-disaster analysis on impacted properties
- Available for all Gray Sky disaster collection from 2022 and forward

*Find out where attributes are available at **vexceldata.com***

Building Attributes	Value
Footprint area	4,626.65ft^2
Ground elevation	527.03 ft
Roof elevation	553.08 ft
Roof height	28.15 ft
Roof Centroid	-74.287889 40.800163
Tree cover over roof	0%
Roof solar	No
Chimney(s)	1
AC unit(s)	0
Roof vent(s)	11
Satellite dish(es)	0
Skylight(s)	6
Roof shape	Hip
Roof material	Shingle
Missing roof material	0%
Roof condition	4/5
Roof discoloration	1.35%
Vent staining	No – 0%
Algae staining	No – 0%
Water pooling	No – 0%
Roof tarp	0%
Debris	0%

Property Attributes	Value
Pool	Yes – 1013.96 ft^2
Pool: In ground-area	Yes – 908.04 ft^2
Pool: Above ground	No - N/A
Hot tub – area	Yes – 106.99 ft^2
Diving board	No
Water slide	Yes
Deck	Yes
Playground	Yes
Trampoline	No
Sports court	No
Hardscapes	Yes – 5898.62 ft^2
Vehicles: automobile	1
Vehicles: boat	0

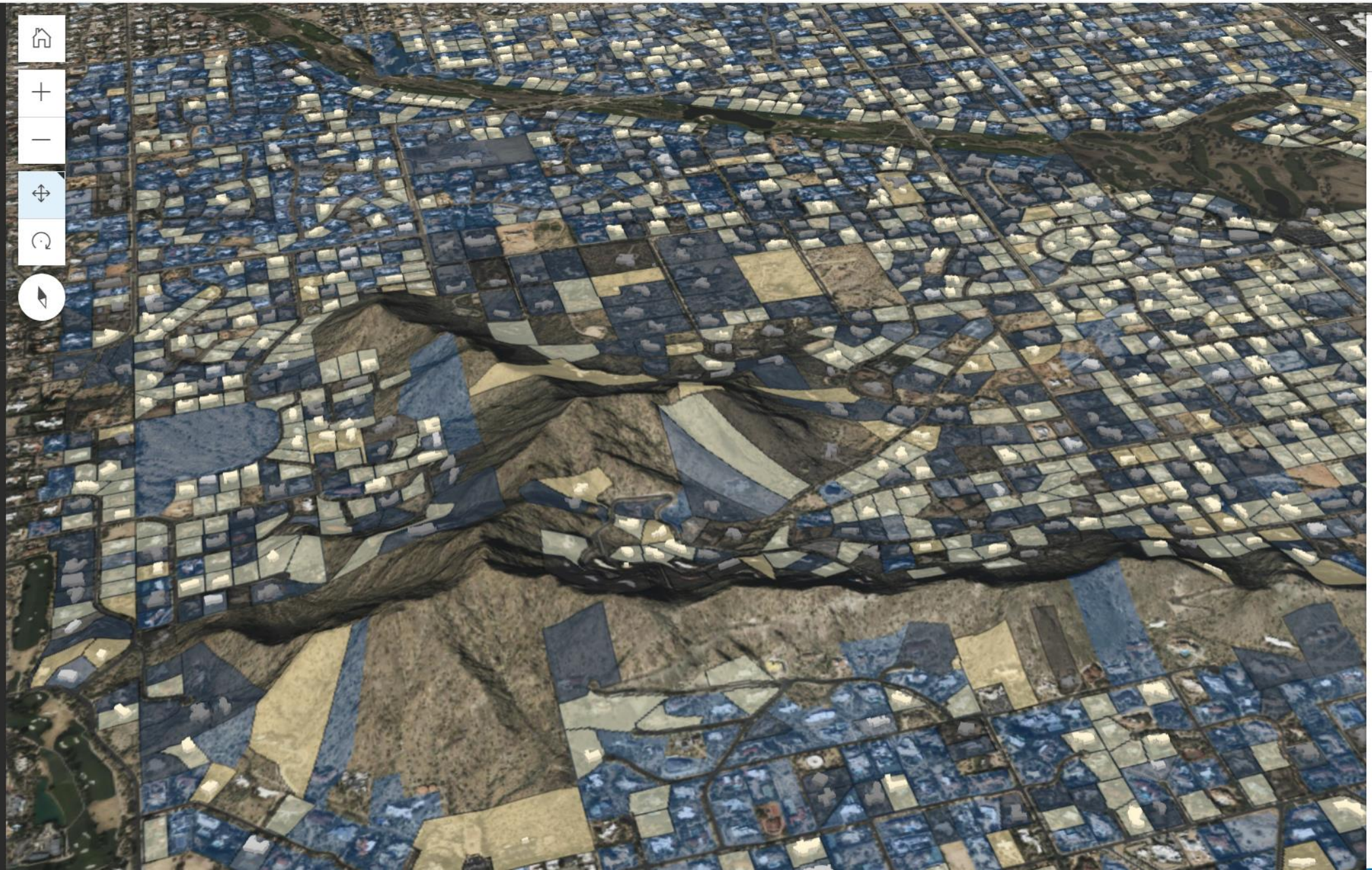

Home
Property Assessment and Road Elements
New Scene
Brian
Search
25

Home
Property Assessment and Road Elements
New Scene
Brian
Layers
Legend
Road Elements
Intersections
Road Elements. Curbs
Road Elements, Cross Walks
Speed Limits
KFactor
Street Centerlines
Parcels with New Pools
Building Additions
Buildings with Roof Condition Change
Building Change
Parcel Change
Building Roof Condition
Building Roof Materials
Buildings by Fire Risk
Parcels with Pools
Buildings
Parcels, Developed
Vexcel True Ortho Imagery - 7.5cm - …

Home

Property Assessment and Road Elements

New Scer



Layers

Legend

Building Change

- none
- minor
- major

Parcel Change

- None
- None
- Minor
- Major

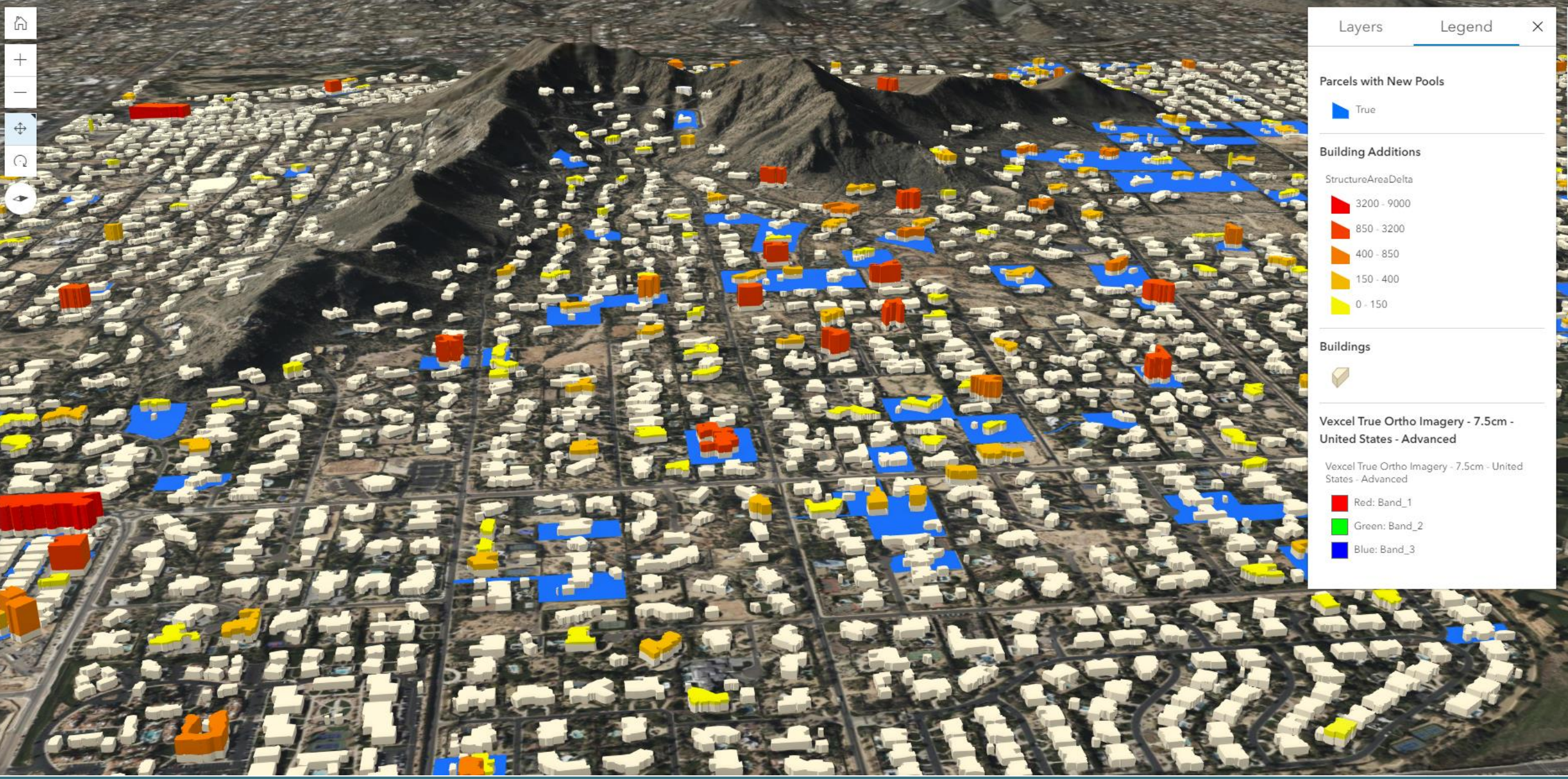
Parcels with Pools

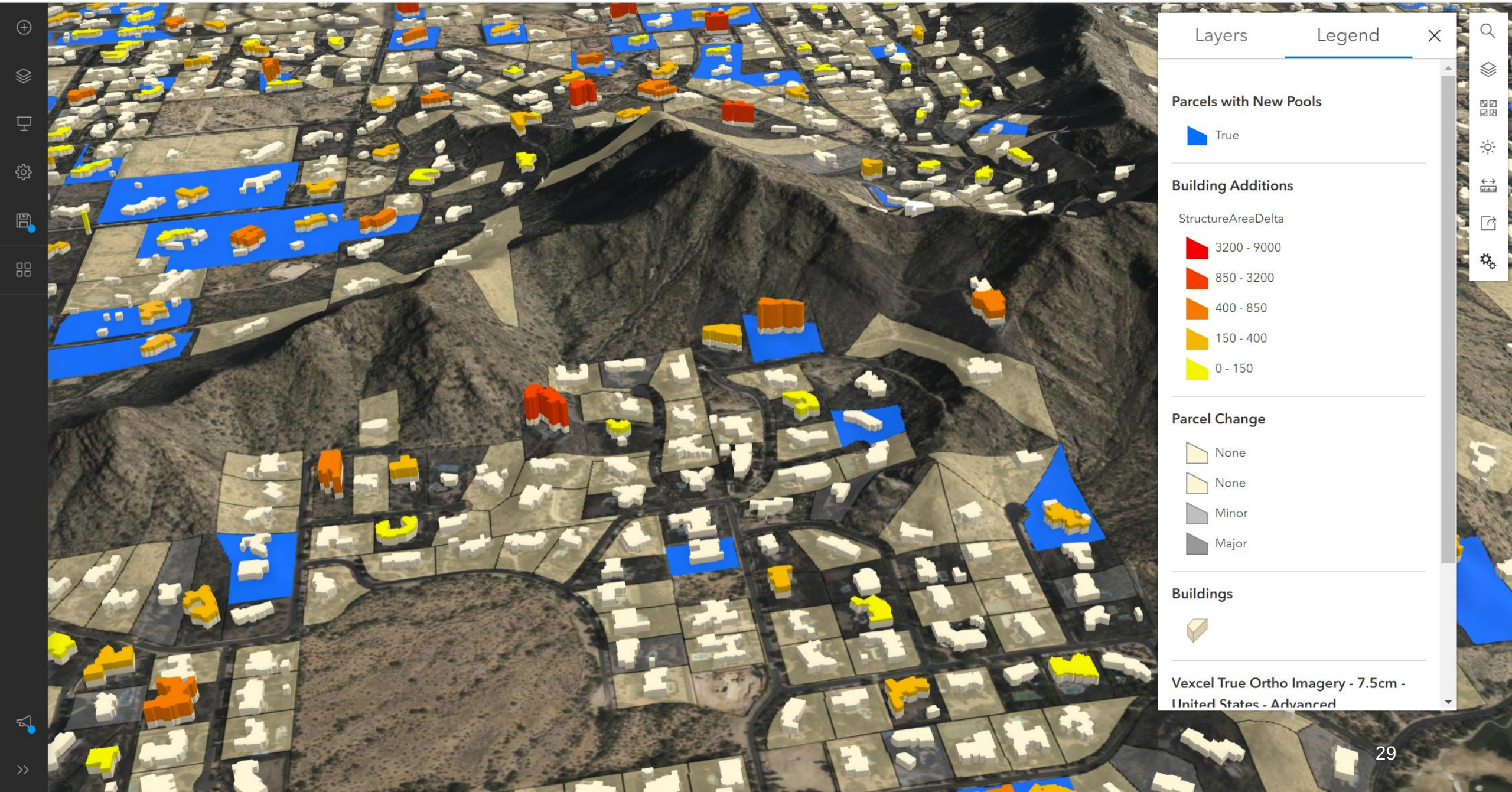
- True

Vexcel True Ortho Imagery - 7.5
United States - Advanced

Vexcel True Ortho Imagery - 7.5cm
States - Advanced

- Red: Band_1
- Green: Band_2
- Blue: Band_3


Layers
Legend
Parcels with New Pools
True
Building Additions
StructureAreaDelta
3200 - 9000
850 - 3200
400 - 850
150 - 400
0 - 150
Buildings
Vexcel True Ortho Imagery - 7.5cm - United States - Advanced
Vexcel True Ortho Imagery - 7.5cm - United States - Advanced
Red: Band_1
Green: Band_2
Blue: Band_3


Home
Property Assessment and Road Elements
New Scene
Brian
Layers
Legend
Parcels with New Pools
True
Building Additions
StructureAreaDelta
3200 - 9000
850 - 3200
400 - 850
150 - 400
0 - 150
Parcel Change
None
None
Minor
Major
Buildings
Vexcel True Ortho Imagery - 7.5cm - United States - Advanced

Layers
Legend
Buildings by Fire Risk
d100
> 39
26
< 13
Buildings
Vexcel True Ortho Imagery - 7.5cm - United States - Advanced
Vexcel True Ortho Imagery - 7.5cm - United States - Advanced
Red: Band_1
Green: Band_2
Blue: Band_3

VEXCEL
DATA PROGRAM

AI/ML based Insights - Disaster Response and Recovery Damage Assessment

Lahaina, Hawaii

Damage Assessment

Our AI analysis identified a total of 2,760 structures within the Lahaina collection area.

- **1,718 structures were completely destroyed**; 62% of all the structures in the collection area.

- **363 structures had slight to moderate damage**, ranging from some fire damage to missing shingles possibly caused from the severe winds that fanned the fires.

- **678 structures had no damage** identified in the imagery.

Lahaina, Hawaii

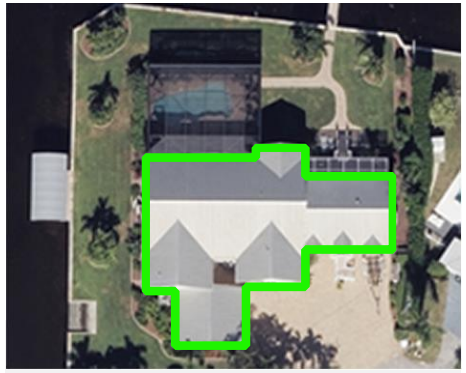
Damage Assessment

Before
Hurricane Ian

After
Home impacted by Hurricane Ian

Property Level Analysis of Damage

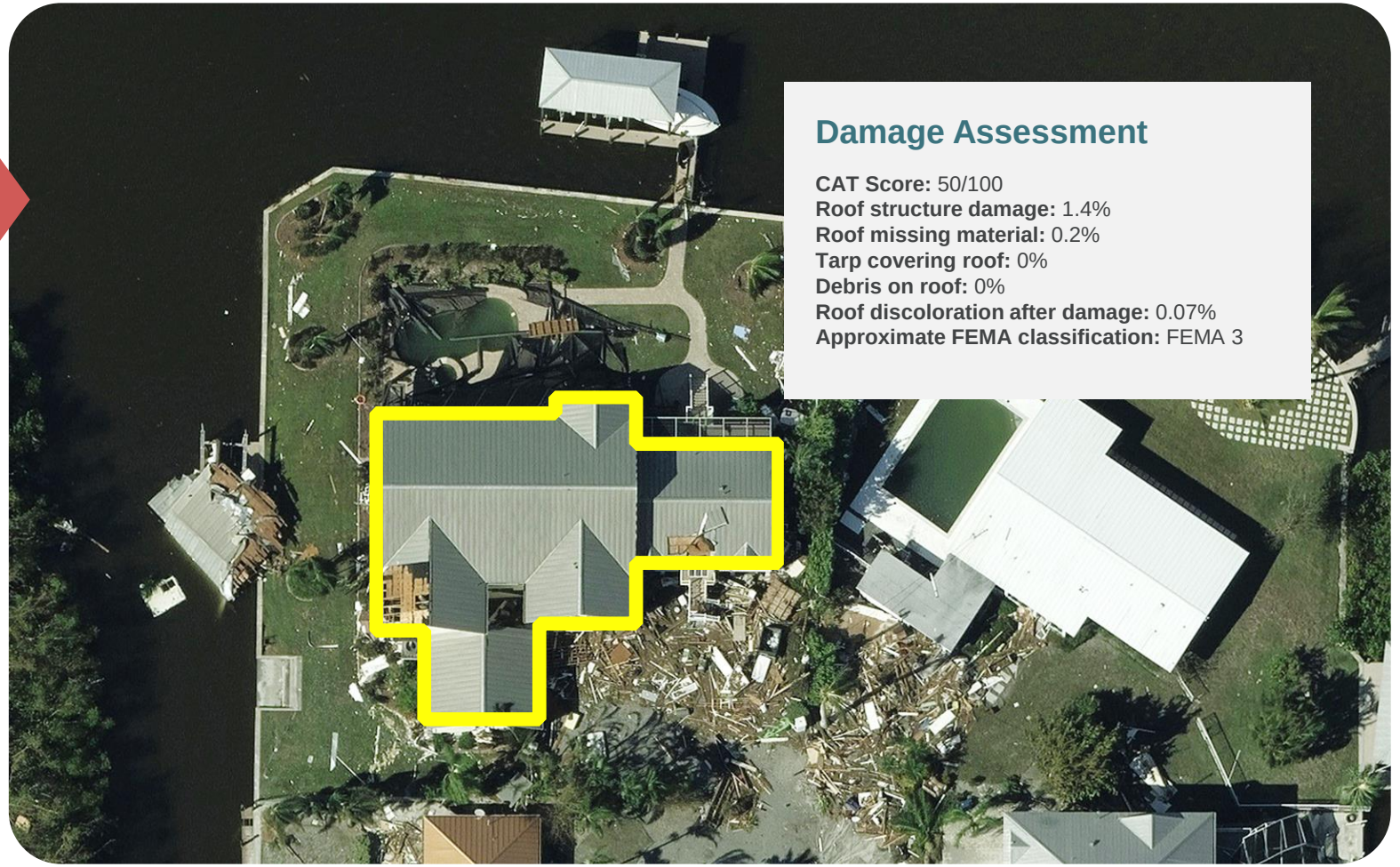
Compare PIFs against this data to identify properties in greatest need



Blue Sky

Footprint area: 526.7m^2
Roof condition: 5/5
Roof material: metal
Roof discoloration: 0%
Roof shape: gable
Roof solar: no
Tree cover over roof: 0%
Defensible space report:

Trees	Buildings
0-5 ft: 0%	0-5 ft: 0%
0-30 ft: 14%	0-30 ft: 5%
0-100 ft: 14%	0-100 ft: 13%
0-200 ft: 0%	0-200 ft: 0%



Damage Assessment

CAT Score: 50/100
Roof structure damage: 1.4%
Roof missing material: 0.2%
Tarp covering roof: 0%
Debris on roof: 0%
Roof discoloration after damage: 0.07%
Approximate FEMA classification: FEMA 3

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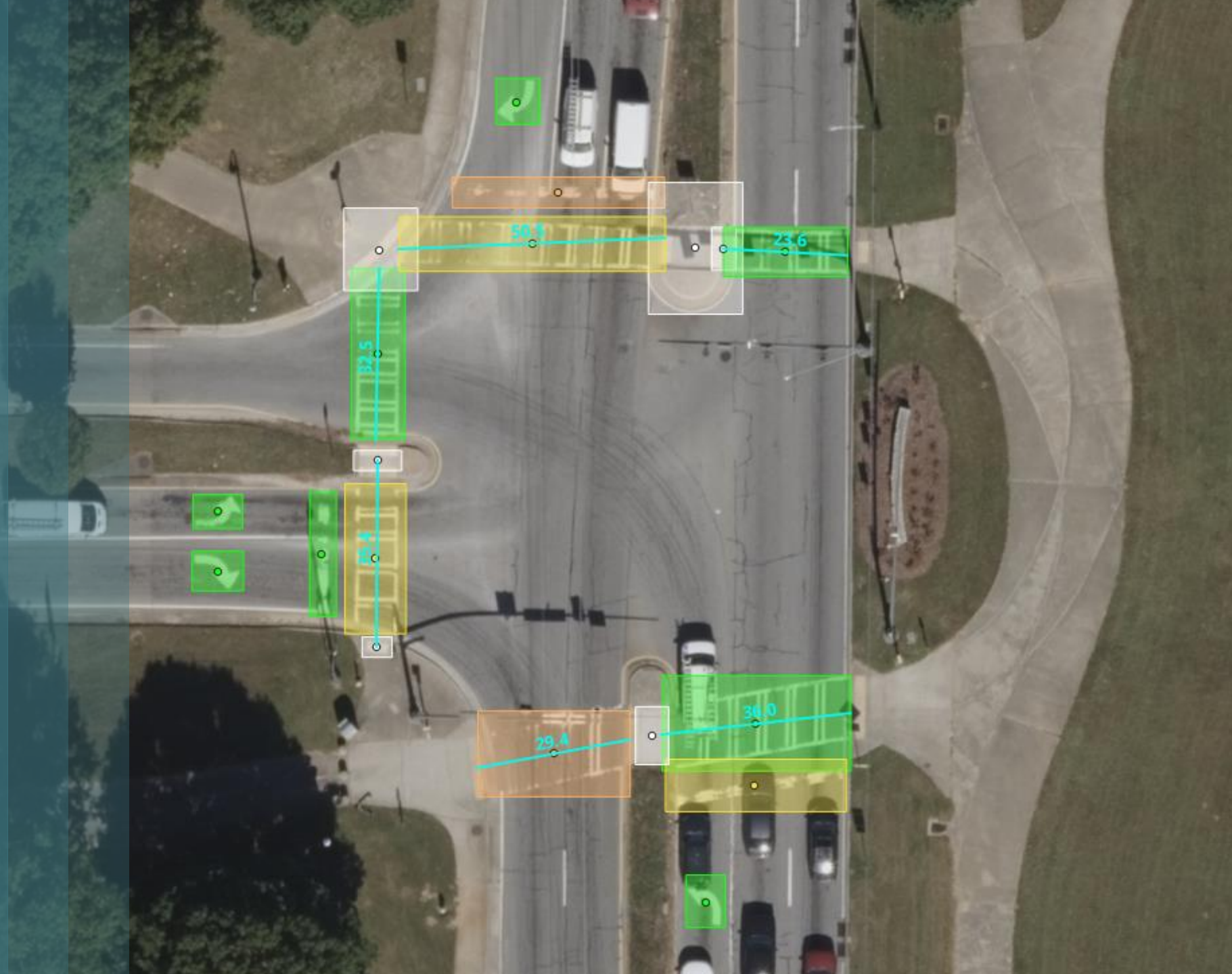
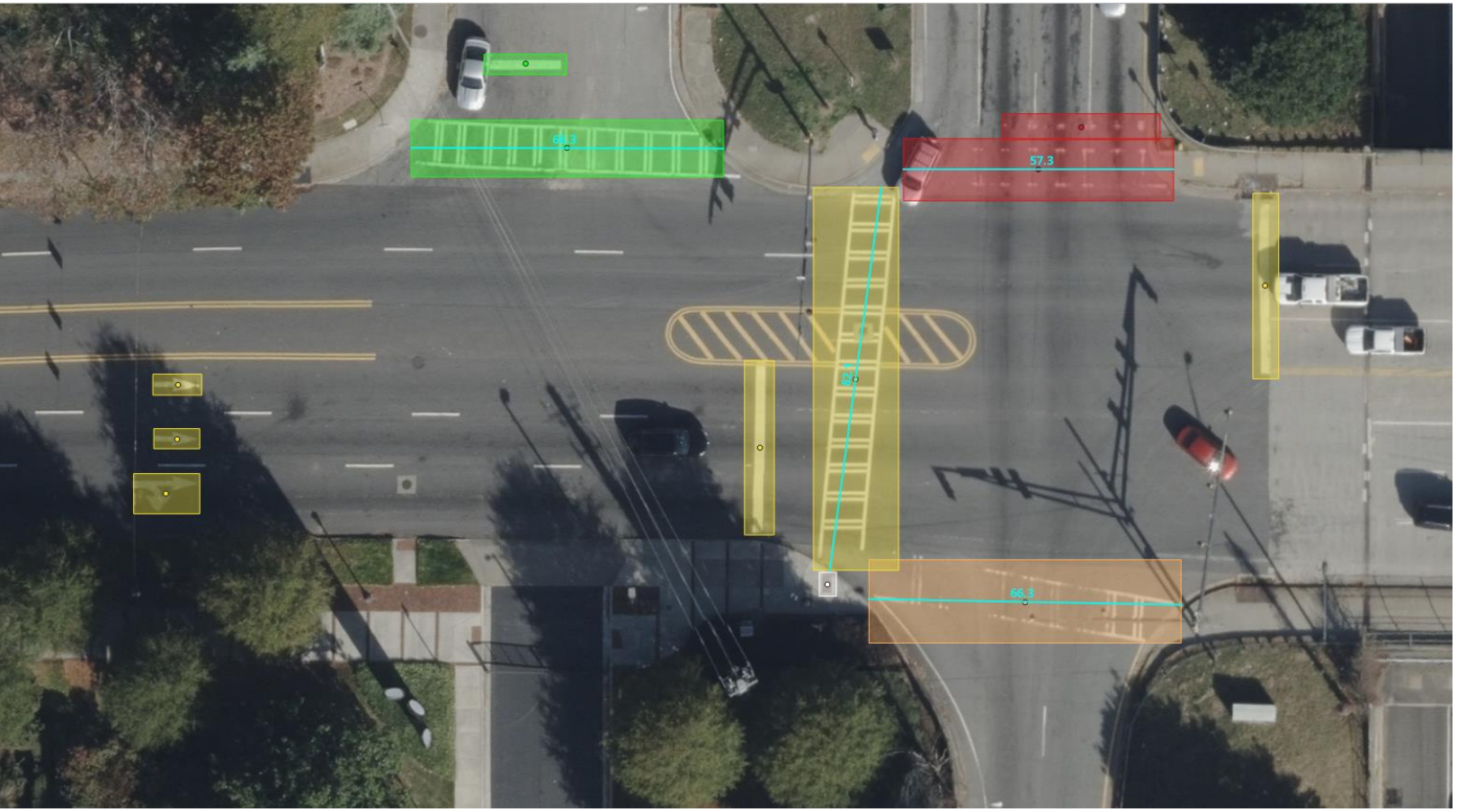
AI/ML based Insights - Roadway Attributes



Roadway Elements

Access 30+ attributes for better, more precise roadway analysis



Pavement Markings

- Crosswalks
- Bicycle symbols
- Arrows
- Words
- Available for current and historical imagery

Infrastructure

- Pedestrian refuge islands
- ADA truncated domes “curb mats”
- Intersection-junctions
- Available for current and historical imagery

Condition Assessment

- Pavement marking quality score for prioritizing maintenance
- Available for current and historical imagery

Roadway Data from High-Resolution Aerial Imagery

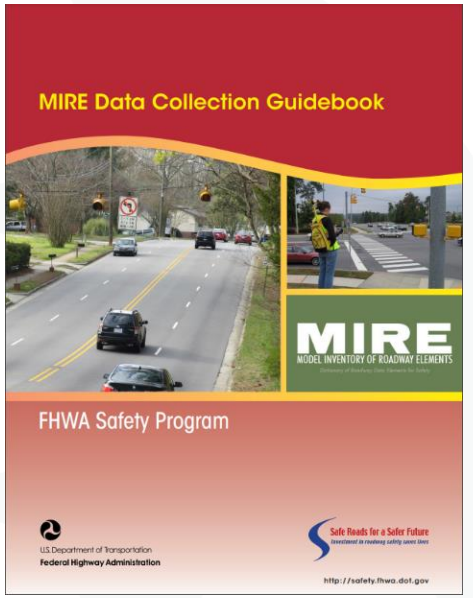
1. **Roadway Inventories for Bike and Pedestrian Facilities**
   - Crosswalks (standard and high visibility) at intersections and midblock
   - Bicycle lanes (symbols, words and green painted lanes)
   - ADA detectable curb mats (truncated dome) and pedestrian refuge islands

2. Roadway Inventories for intersections and approaches
   - Exclusive Left-turn and Right-turn lanes
   - Presence/Absence of crosswalks
   - Presence/Absence of bicycle facilities

3. Condition Assessment of Road Markings for Maintenance Prioritization
   - Identification of faded or worn pavement markings
   - Development of predication models based on historic imagery

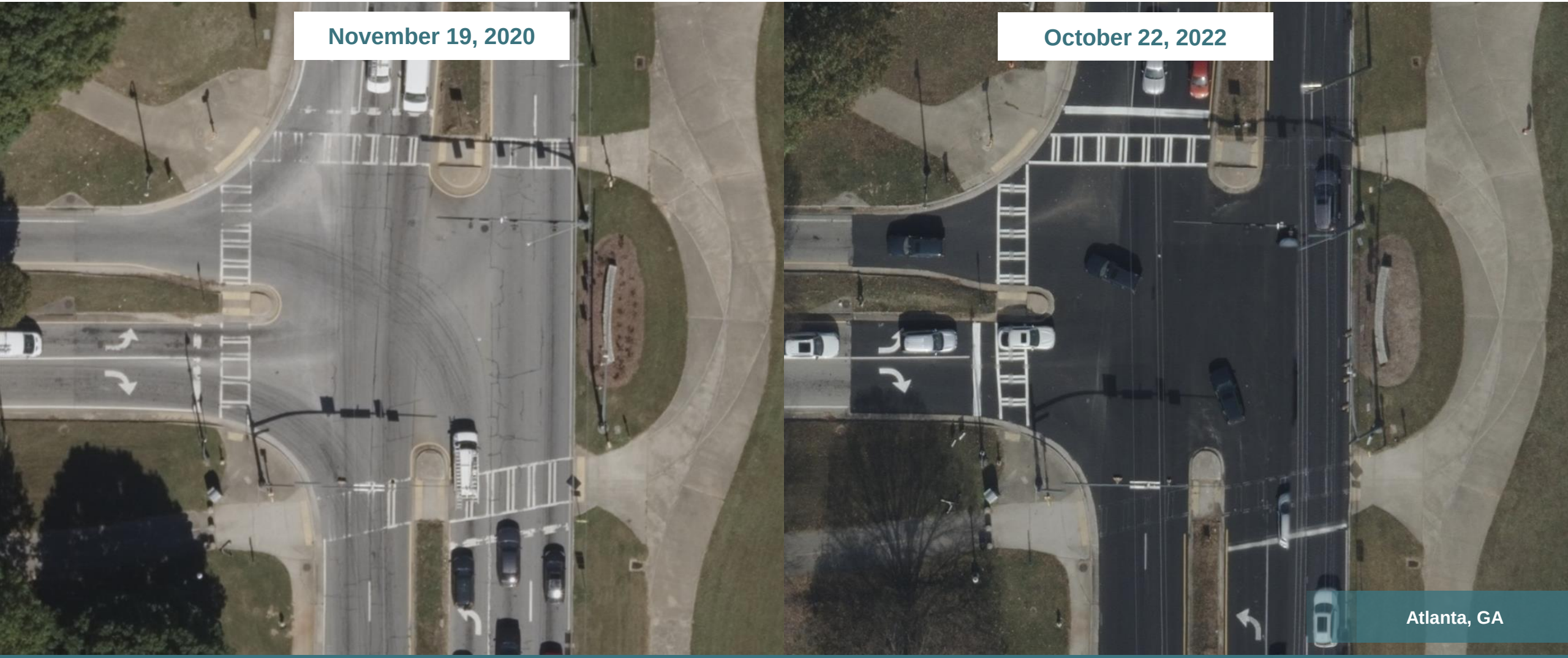
4. ADA Compliance Assessment
   - Mapping of required detectable warnings on curb ramps per DOT ADA standards

5. Confirm and Document Installation of Countermeasures
   - Creation of as-builts for FWHA proven Pedestrian/Bicyclist countermeasures[1] (e.g., high-visibility crosswalks, advance stop and yield lines, ped. refuge islands).

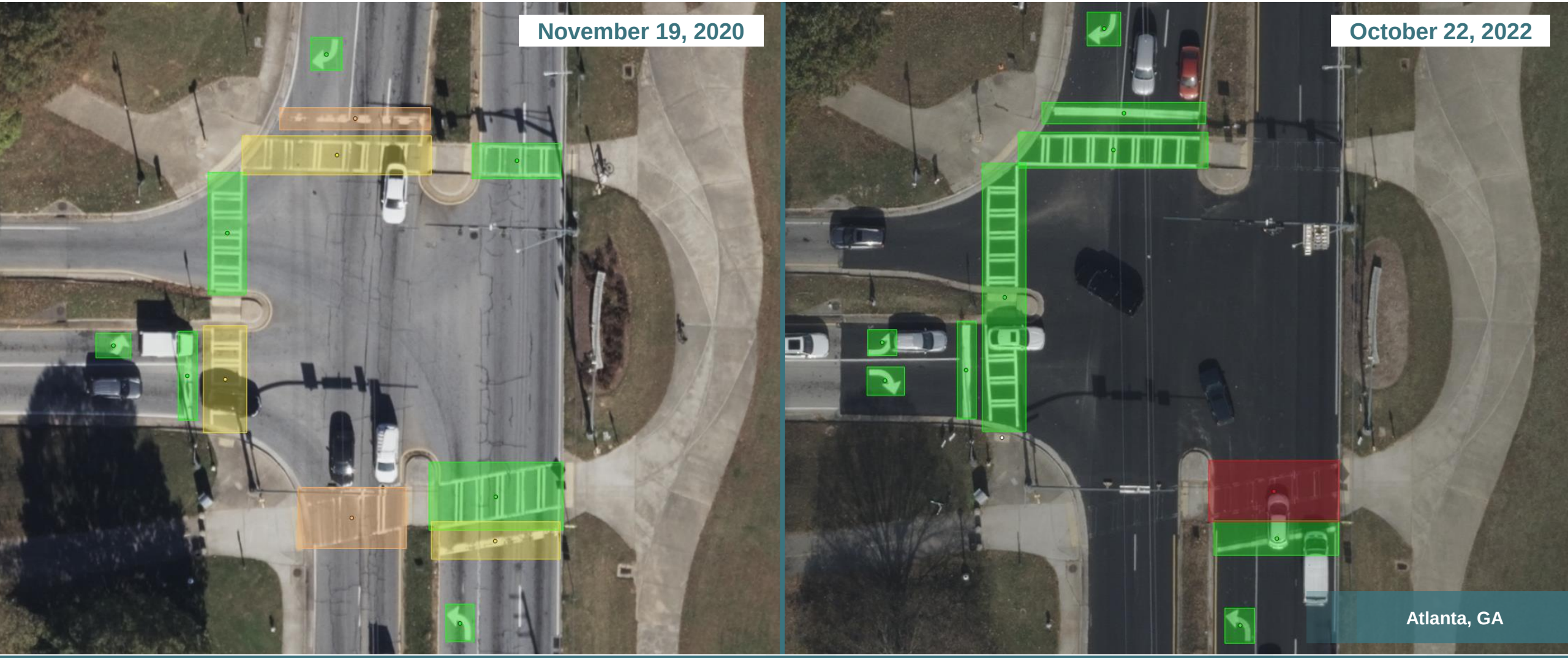


https://highways.dot.gov/safety/proven-safety-countermeasures

Pavement Marking Condition Comparison

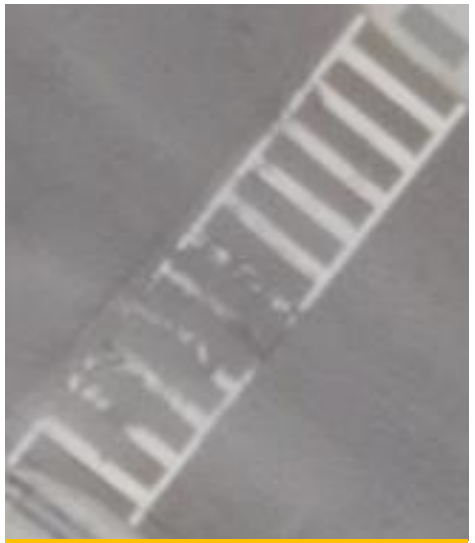


Roadway Inventories, Condition and Change Over Time

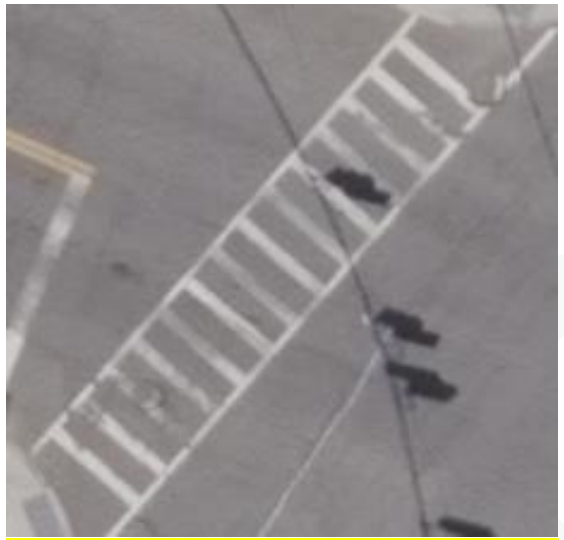


Pavement Marking Condition Scoring

Poor: 1



Fair: 2



Good: 3

Great: 4

Scored between 1-4 based on pavement marking imagery classified using subjective condition assessment markings.

- 4 = Great. No visible signs of defects.
- 3 = Good. Minimal signs of defects.
- 2 = Fair. Pronounced signs of defects that affect the function of the marking.
- 1 = Poor. Pronounced signs of defects that significantly affect the function of the marking.

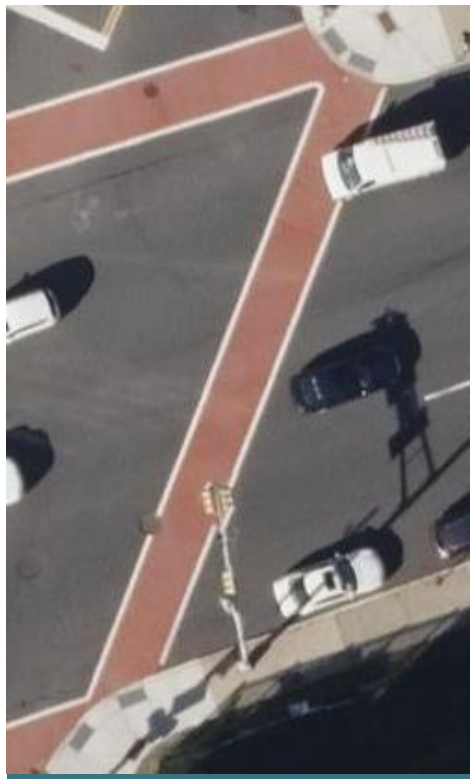
VEXCEL
DATA PROGRAM

Pedestrian and Bicycle Markings

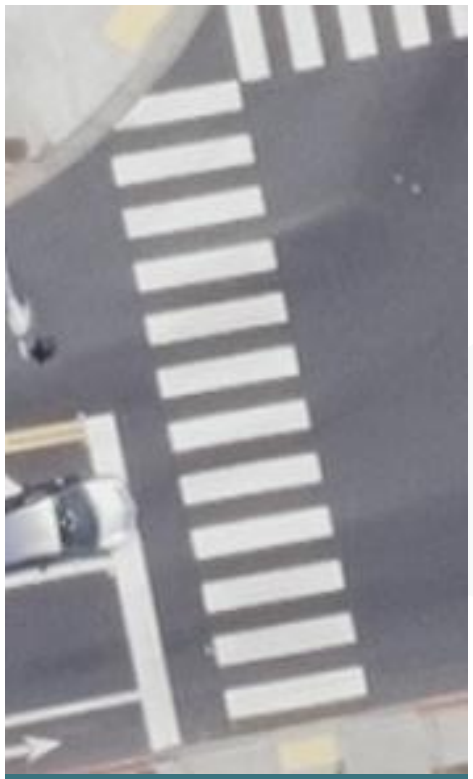
Atlanta, GA

Crosswalk Identification and Classification

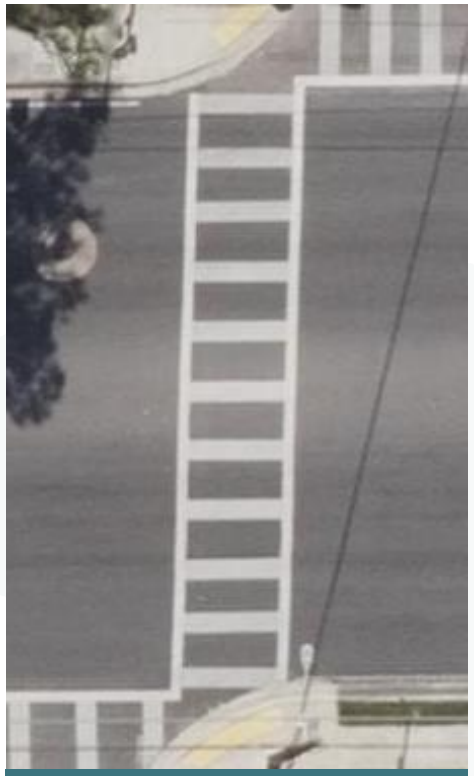
Standard



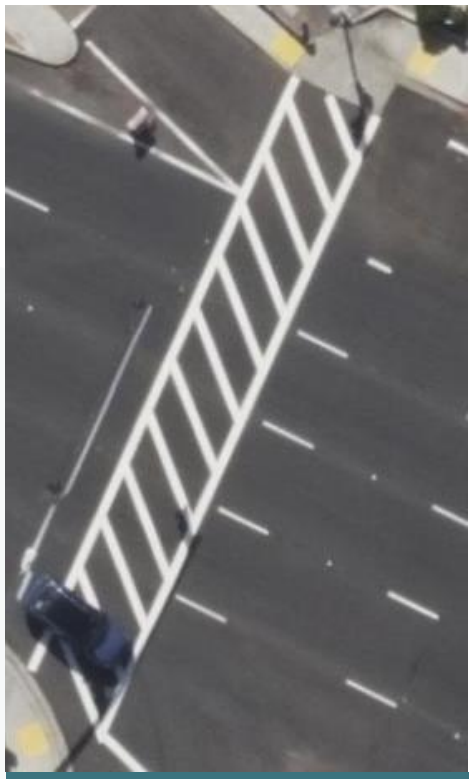
Solid



Zebra (Continental)



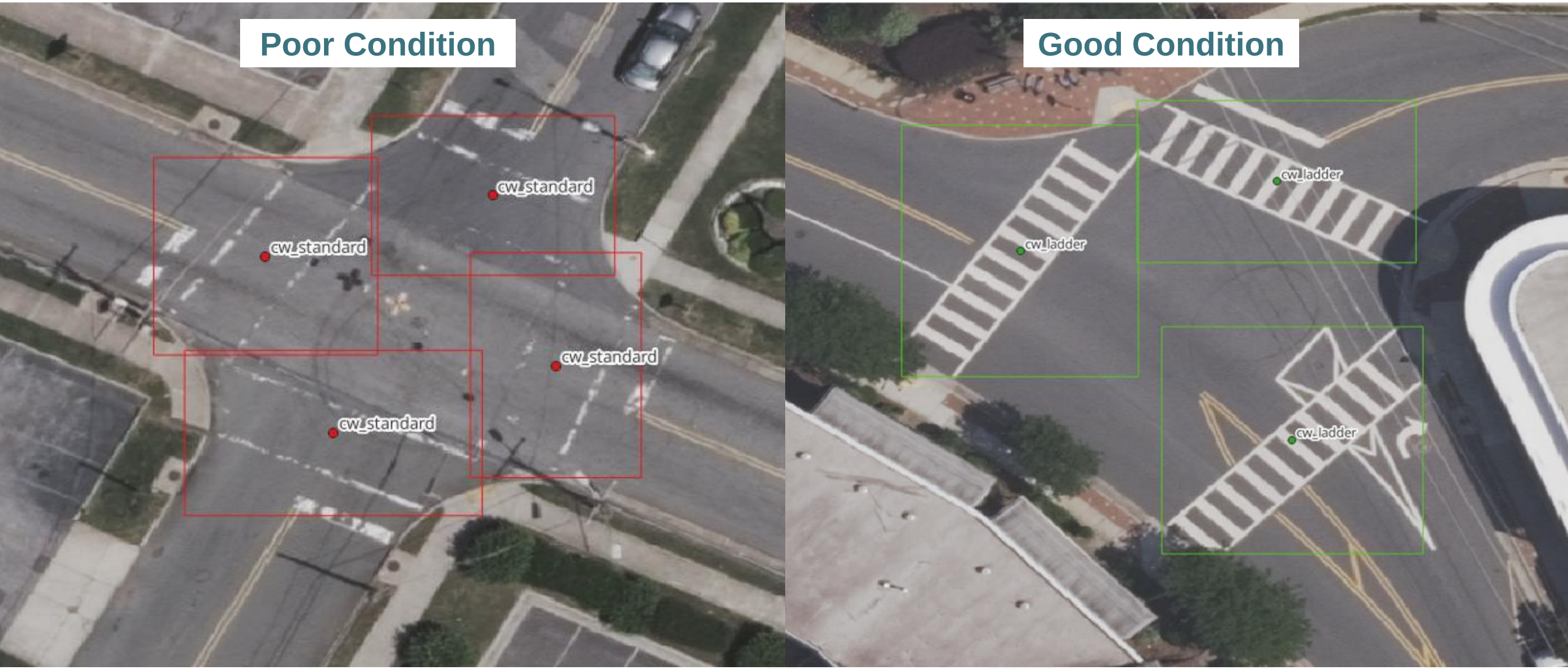
Ladder



Diagonal

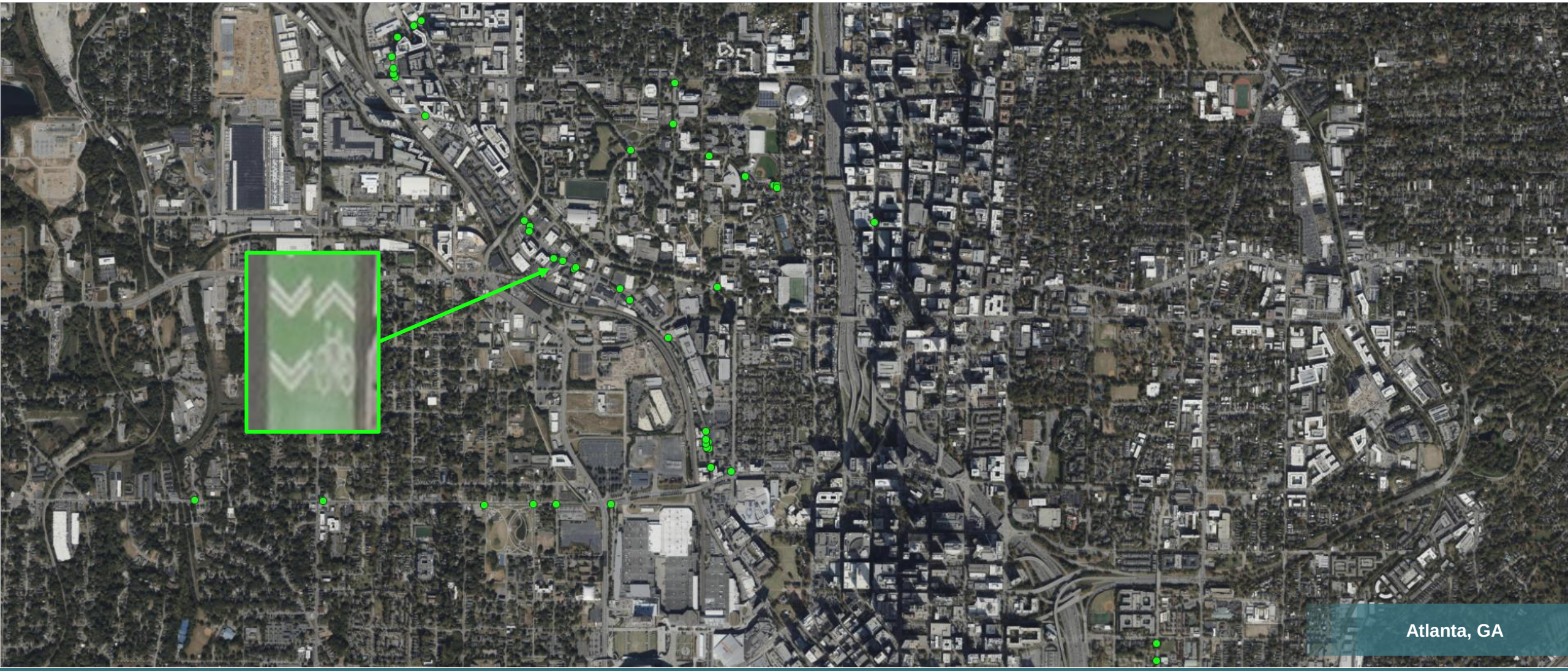
Crosswalk Compliance Assessment: Low vs. High Visibility

Crosswalk Condition Assessment

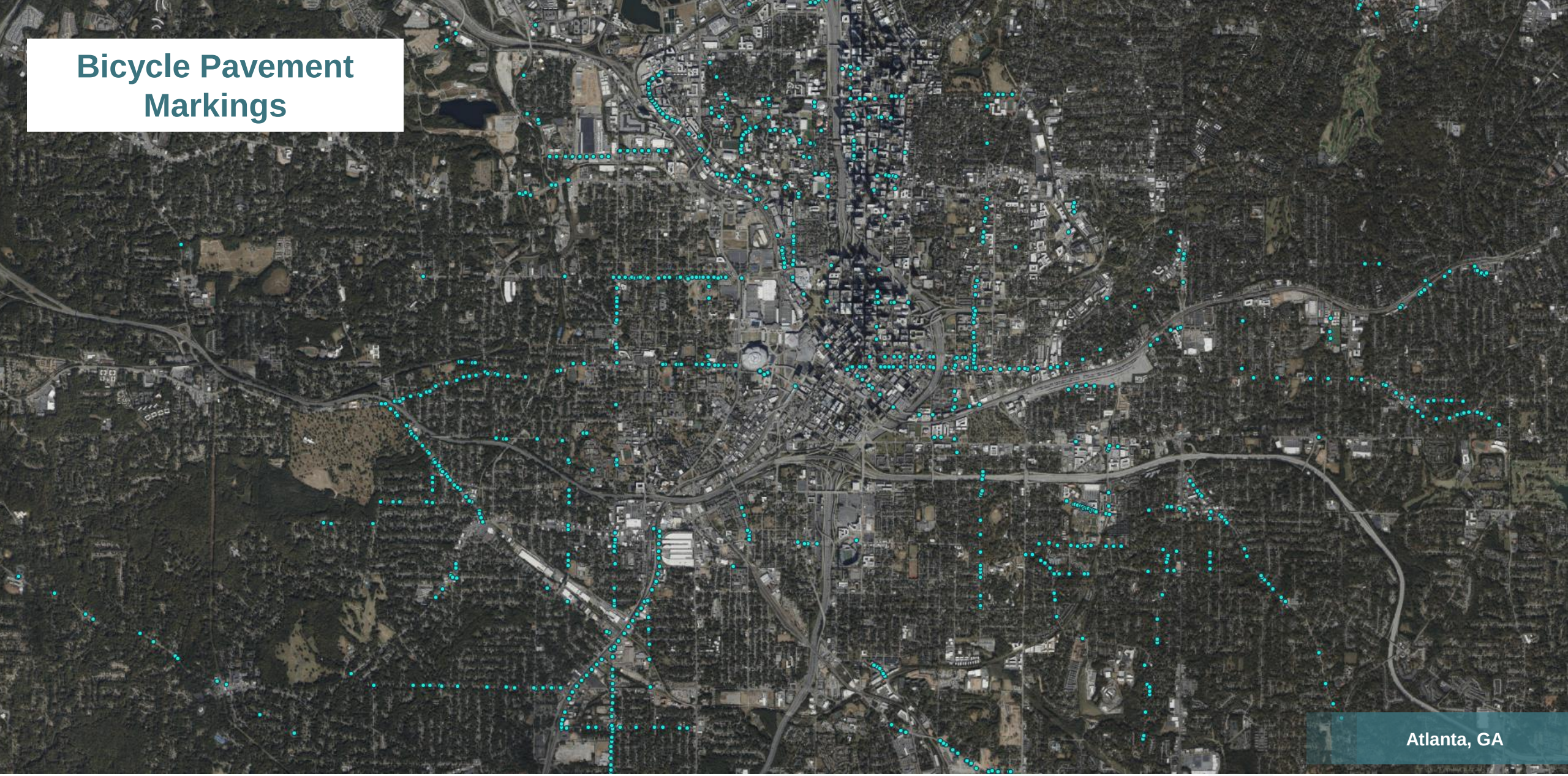


Bike Lane Mapping using Bicycle Pavement Markings

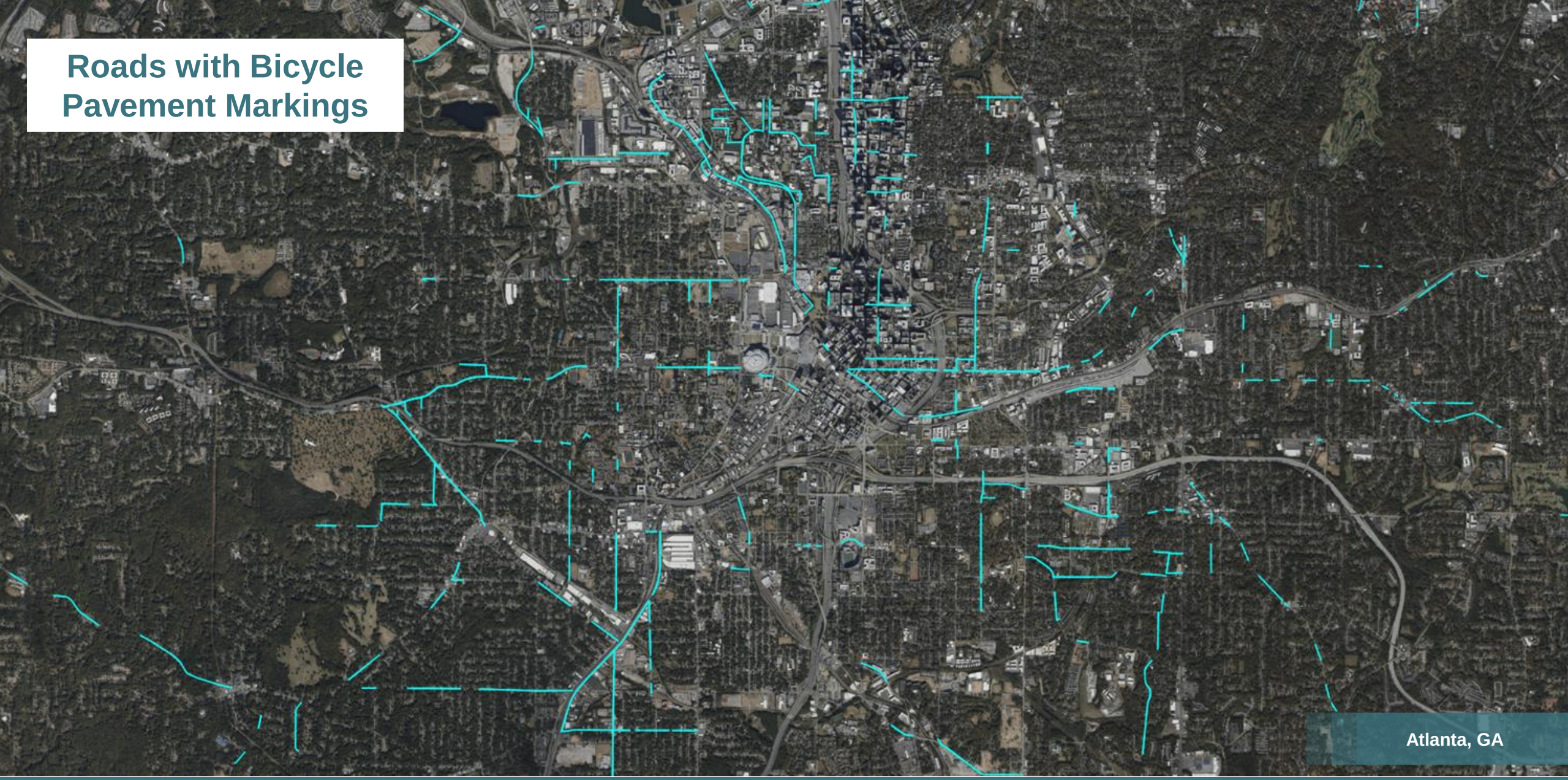
Bike Lane Mapping using Bicycle Pavement Markings



Bicycle Pavement Markings



Roads with Bicycle Pavement Markings



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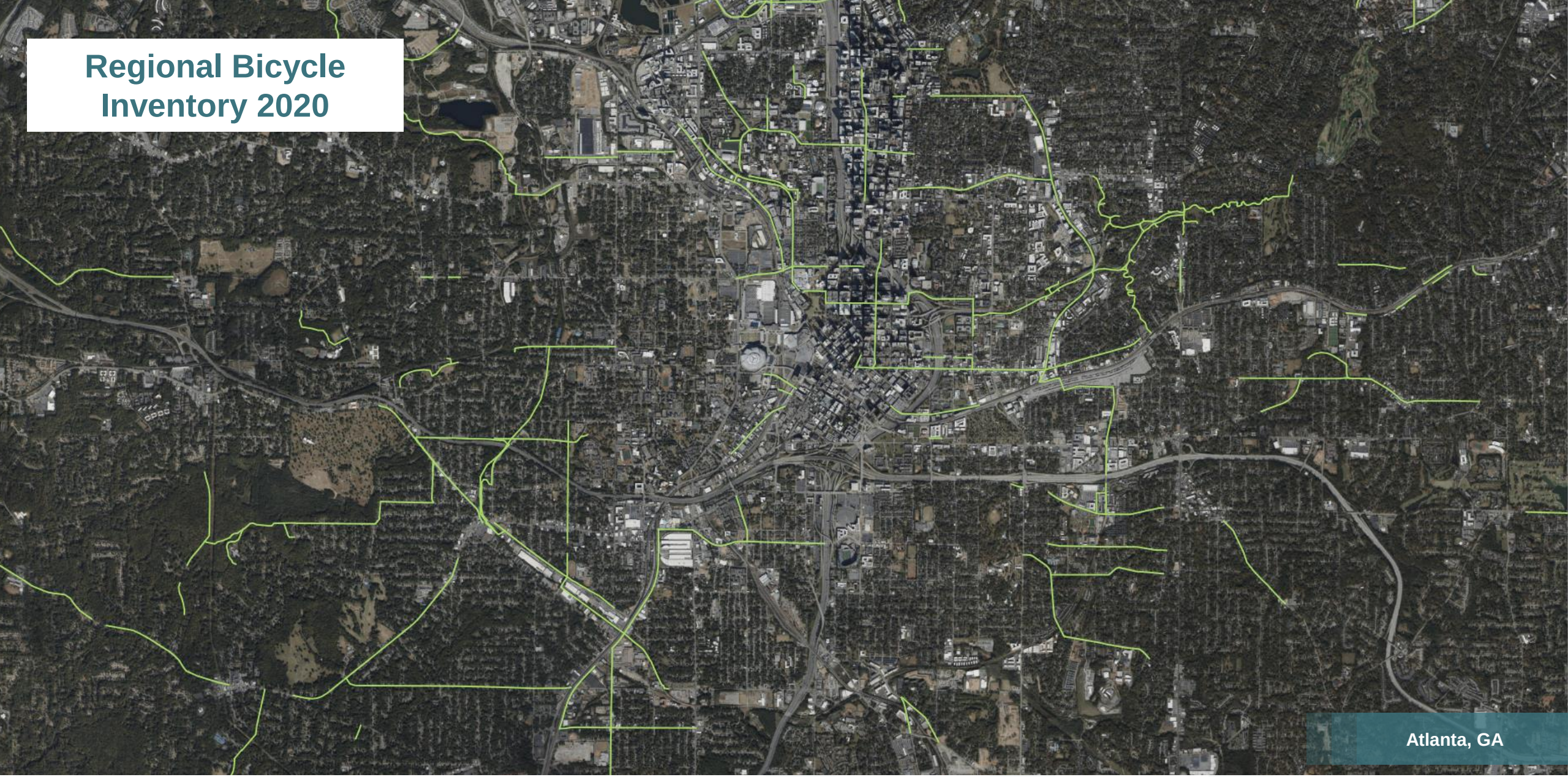
Regional Bicycle Inventory 2020



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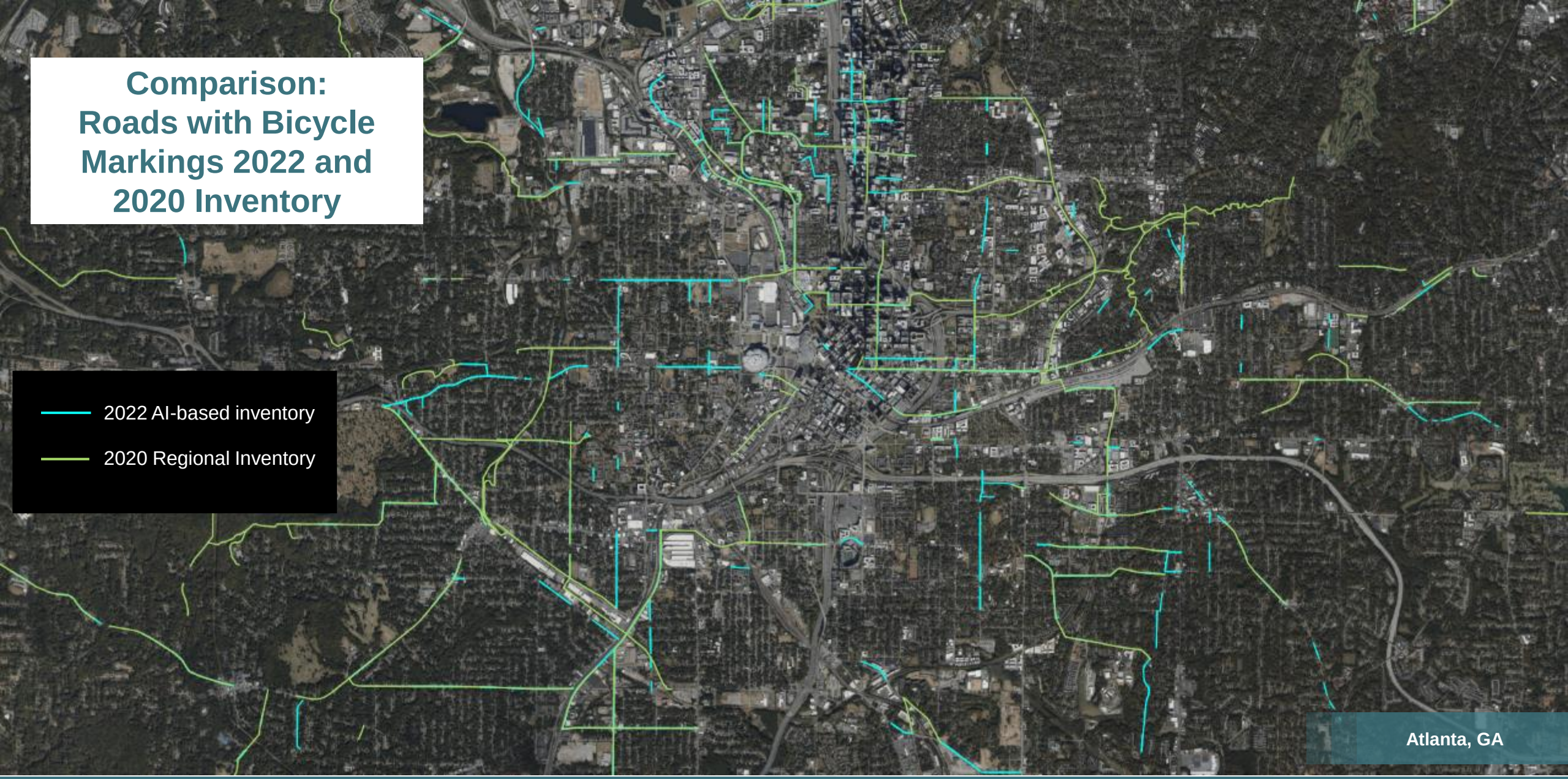
Comparison: Roads with Bicycle Markings 2022 and 2020 Inventory



Bicycle Facility Improvements: Before

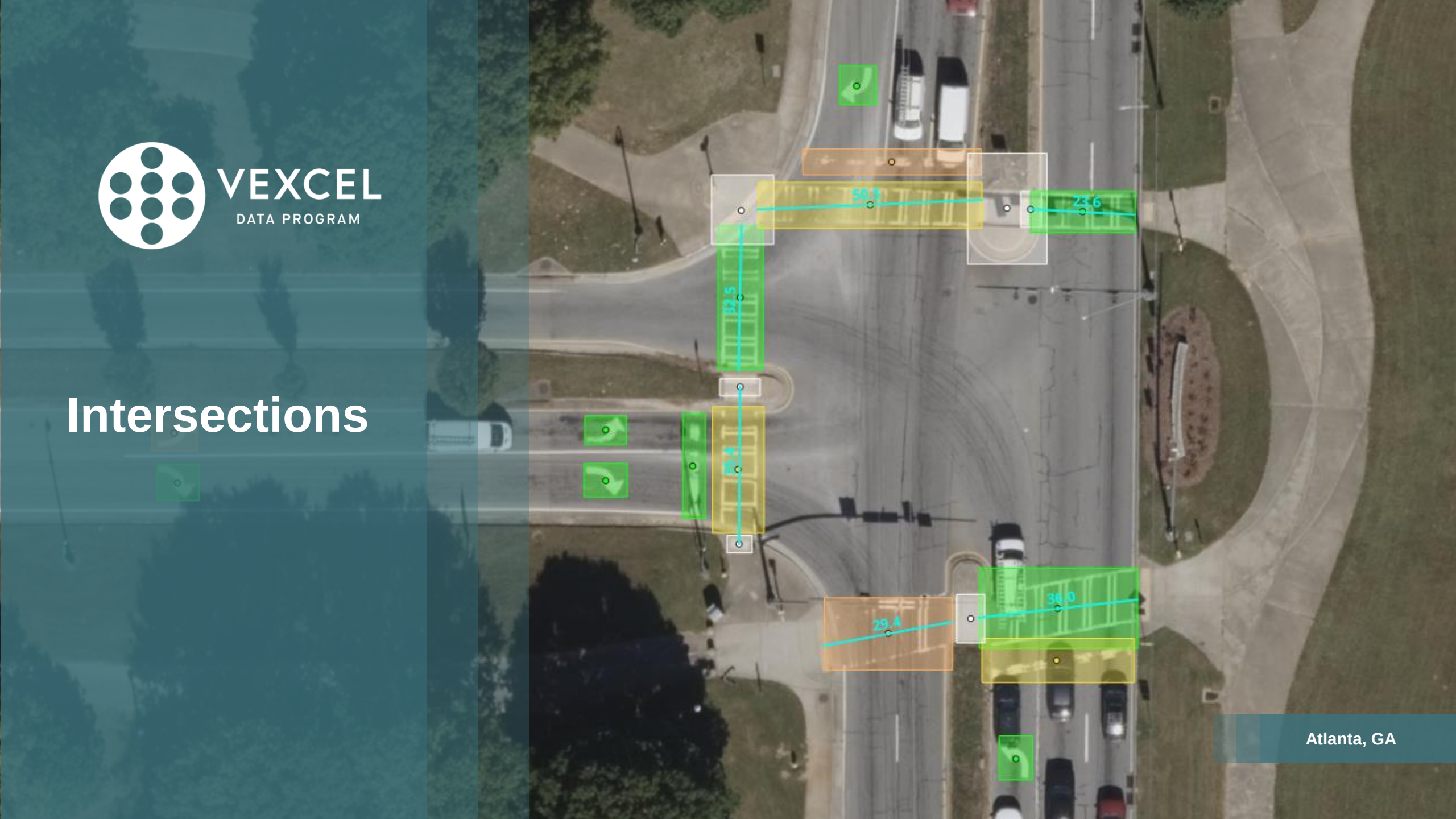
2020

Bicycle Facility Improvements: After

2022

VEXCEL
DATA PROGRAM

Intersections



Atlanta, GA

FHWA MIRE ELEMENTS

FHWA MIRE FDE

NON-LOCAL PAVED ROADS
Intersection

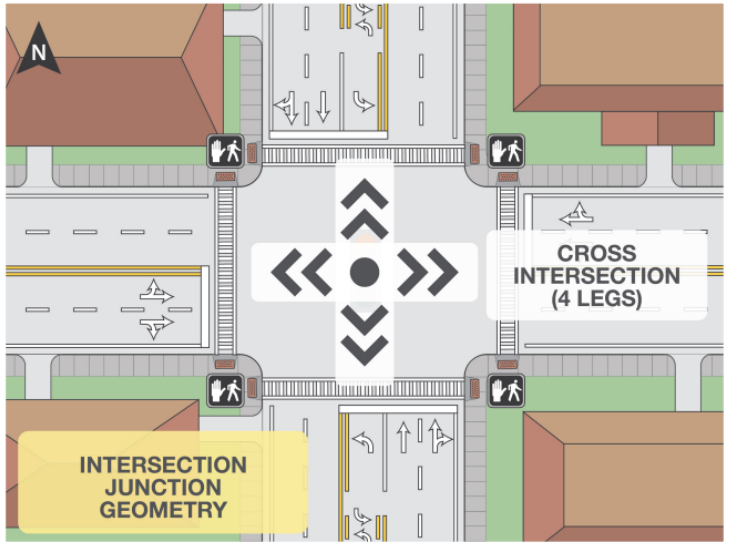
Intersection/Junction Geometry (116)

Definition: The type of geometric configuration that best describes the intersection/junction.

Recommended Attributes:

1. T-Intersection.
2. Y-Intersection.
3. Cross-Intersection (four legs).
4. Five or more legs and not circular.
5. Roundabout.
6. Other circular intersection (e.g., rotaries, neighborhood traffic circles).
7. Midblock pedestrian crossing.
8. Restricted crossing U-turn (i.e., RCUT, J-turn, Superstreet) intersection.
9. Median U-turn (i.e., MUT, Michigan Left, Thru-turn) intersection.
10. Displaced left-turn (i.e., DLT, continuous flow (CFI)) intersection.
11. Jughandle (i.e., New Jersey jughandle) intersection.
12. Continuous green T intersection.
13. Quadrant (i.e., quadrant roadway) intersection.
14. Other.

Note: This element has been changed since MIRE 1.0. In MIRE 1.0, this element has 8 attributes. In MIRE 2.0 this element has 14 attributes.



32 Source: FHWA

FHWA MIRE FDE

NON-LOCAL PAVED ROADS
Intersection

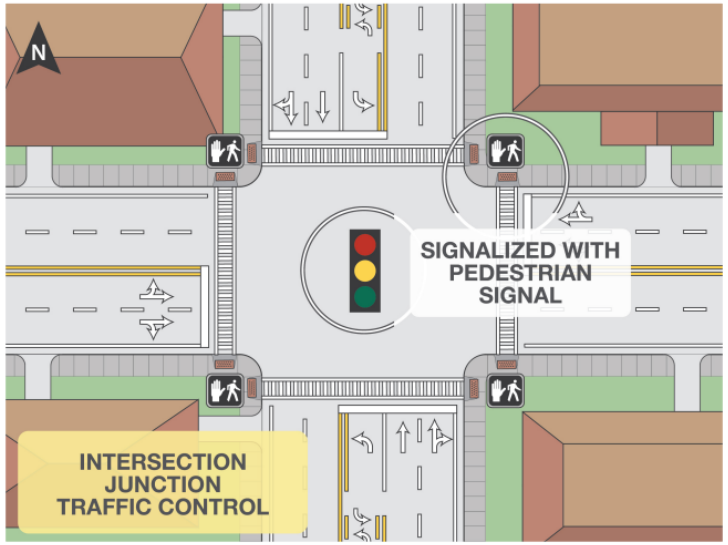
Intersection/Junction Traffic Control (121)

Definition: Traffic control present at intersection/junction.

Recommended Attributes:

1. Uncontrolled.
2. Two-way stop.
3. All-way stop.
4. Yield sign.
5. Signalized.
6. Pedestrian Hybrid Beacon (PHB or High-Intensity Activated Crosswalk [HAWK]).
7. Flash Beacon (include Rectangular Rapid Flash Beacon).
8. Railroad crossing, gates and flashing lights.
9. Railroad crossing, flashing lights only.
10. Railroad crossing, stop-sign controlled.
11. Railroad crossing, crossbucks only.
12. Other.

Note: This element has been changed since MIRE 1.0. In MIRE 1.0, there are 11 attributes. In MIRE 2.0, there are 12 attributes with more detail regarding type of signalization.



33 Source: FHWA

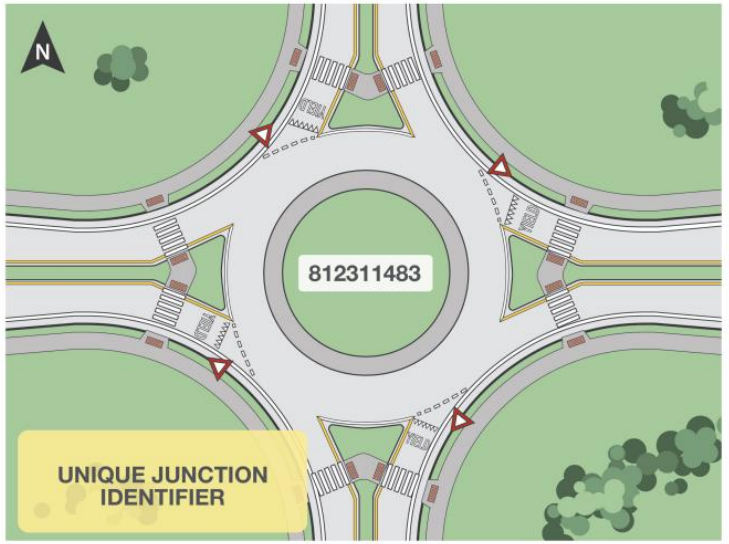
FHWA MIRE FDE

NON-LOCAL PAVED ROADS
Intersection: Circular

Unique Junction Identifier (110)

Definition: A unique junction identifier.

Recommended Attributes: User defined (e.g., node number, LRS of primary route, etc.).



38 Source: FHWA

Source: https://highways.dot.gov/sites/fhwa.dot.gov/files/MIRE_FDE_Example_Illustrations_508.pdf

FHWA MIRE ELEMENTS

136. Number of Exclusive Left-Turn Lanes

Definition: Number of exclusive left-turn lanes that accommodate left turns from this approach.

Recommended Attributes:

Numeric

140. Number of Exclusive Right-Turn Lanes

Definition: Number of exclusive right-turn lanes on approach.

Recommended Attributes:

Numeric

41. Presence/Type of Bicycle Facility

Definition: The presence and type of bicycle facility on the segment.

Recommended Attributes:

1. None
2. Wide curb lane with no bicycle markings
3. Wide curb lane with bicycle markings (e.g., sharrows)
4. Marked bicycle lane
5. Separate parallel bicycle path
6. Signed bicycle route only (no designated bicycle facility)
7. Other

147. Crosswalk Presence/Type

Definition: Presence and type of crosswalk crossing this approach leg.

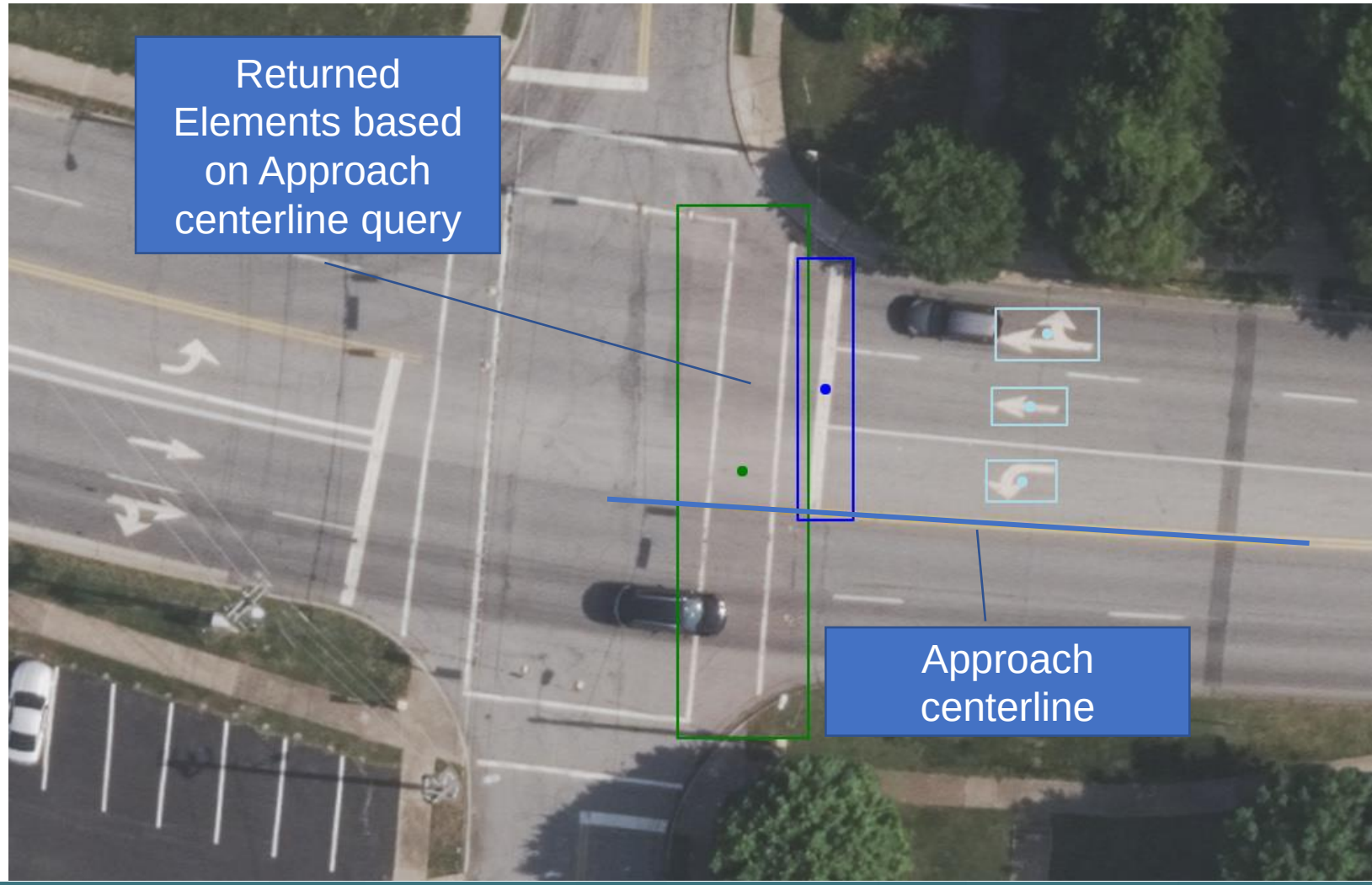
Recommended Attributes:

1. Unmarked crosswalk
2. Marked crosswalk
3. Marked crosswalk with supplemental devices (e.g., in-street yield signs, in-pavement warning lights, pedestrian bulb outs, etc.)
4. Marked crosswalk with refuge island
5. Marked with refuge island and supplemental devices (e.g., in-street yield signs, in-pavement warning lights, pedestrian bulb outs, etc.)
6. Raised crosswalk
7. Pedestrian crossing prohibited at this approach
8. Other

Source: https://highways.dot.gov/sites/fhwa.dot.gov/files/2022-06/fhwasa17048.pdf

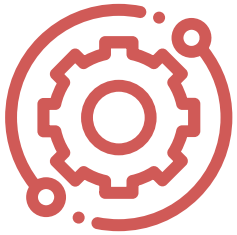
FWHA MIRE Reporting - Approaches

MIRE Element #	Element Name	Attribute
147	Crosswalk Presence/Type	Marked crosswalk
136	Number of Exclusive Left-Turn Lanes	1
140	Number of Exclusive Right-Turn Lanes	0
41	Presence/Type of Bicycle Facility	None



Access & Delivery

Use Vexcel data how and where you want it



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Thank You

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Vexcel Government Solutions
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Albany, NY