VEXCEL
DATA PROGRAM

Better Answers Now Not Later

Prioritizing Workflows w/ AI/ML on Aerial Imagery

Mark Davis
General Manager
Vexcel Government Solutions
Mark.Davis@Vexcelgroup.com

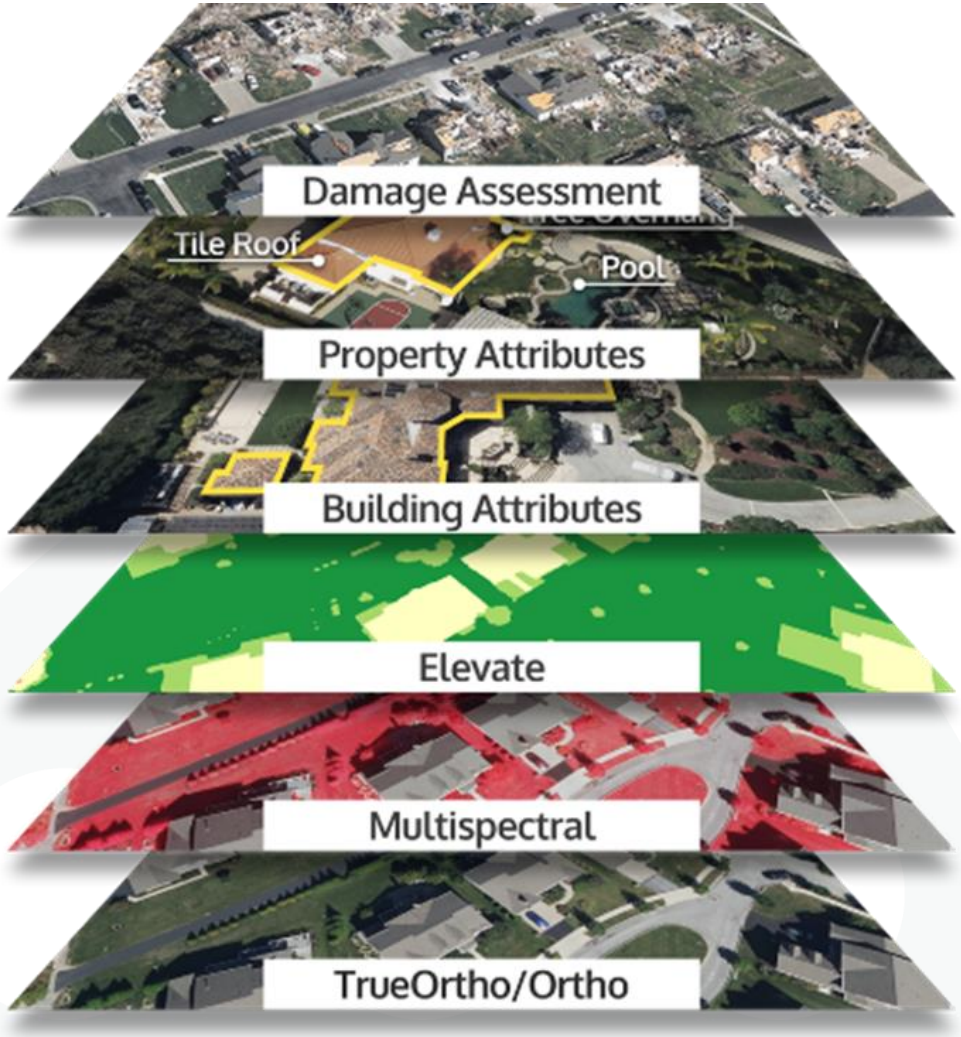
Agenda

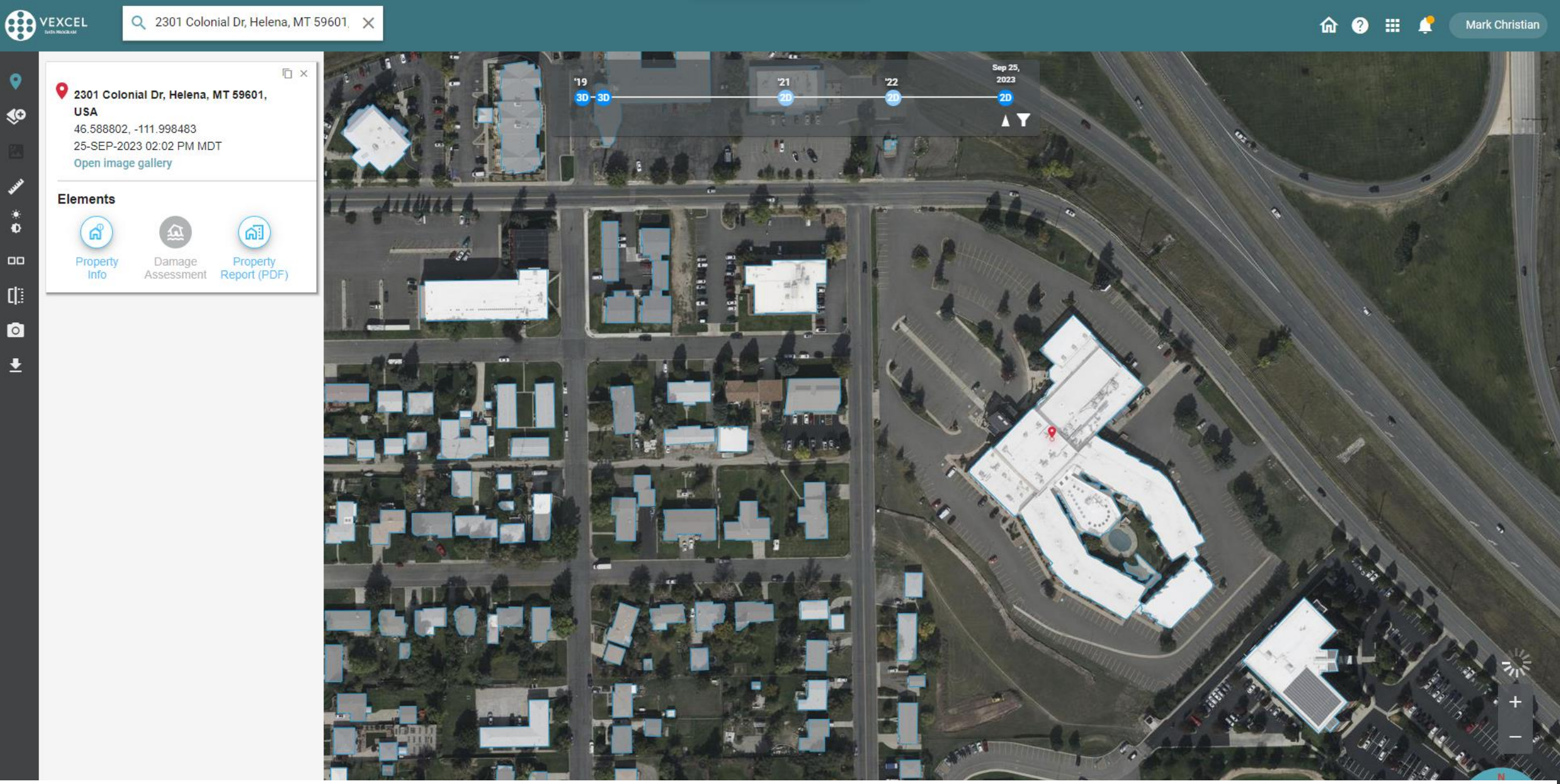
- Trends in Aerial Imagery
- Imagery “Stack” and Coverage
- Extracting Insights
- High Impact Use-Cases

No silver bullet

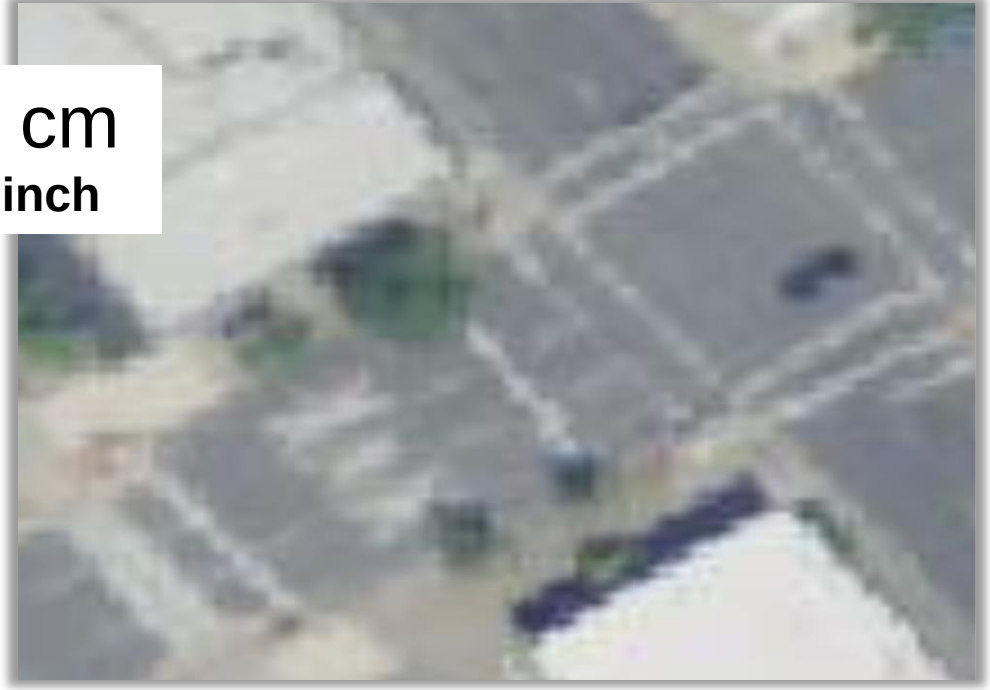
and

Understanding needs will drive selection process



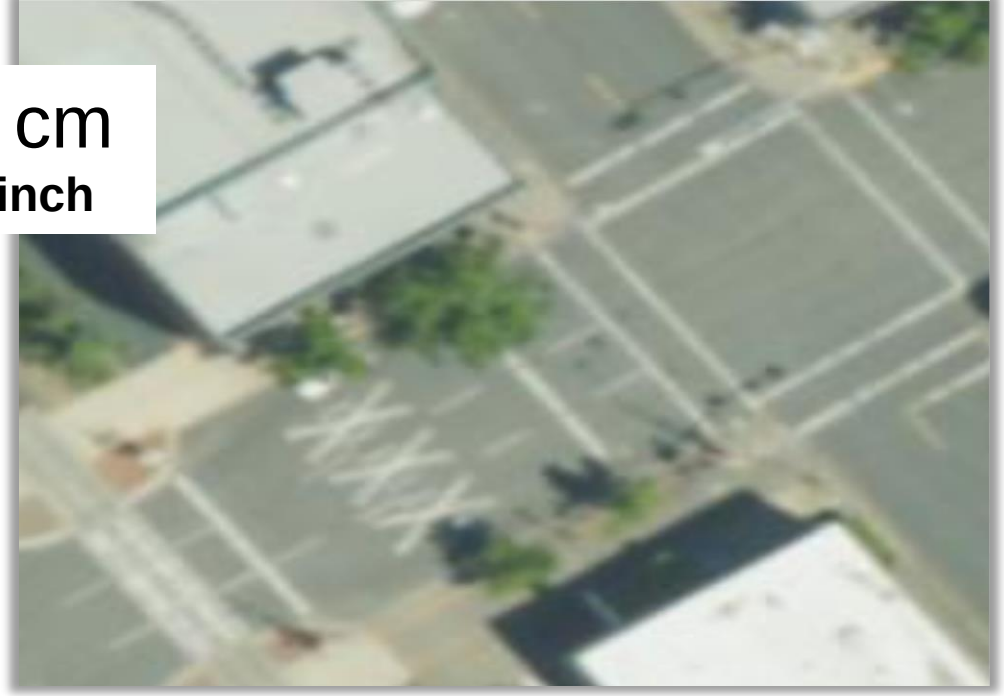


Growing Utilization of High-Resolution Imagery & Analytics

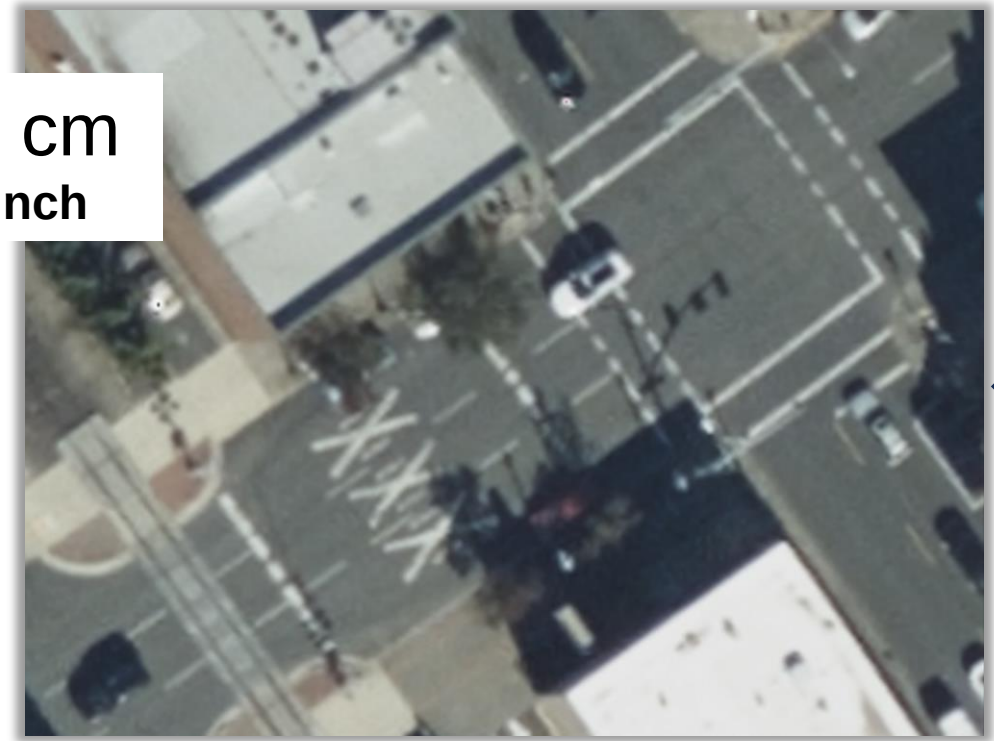


60 cm
24 inch

NAIP

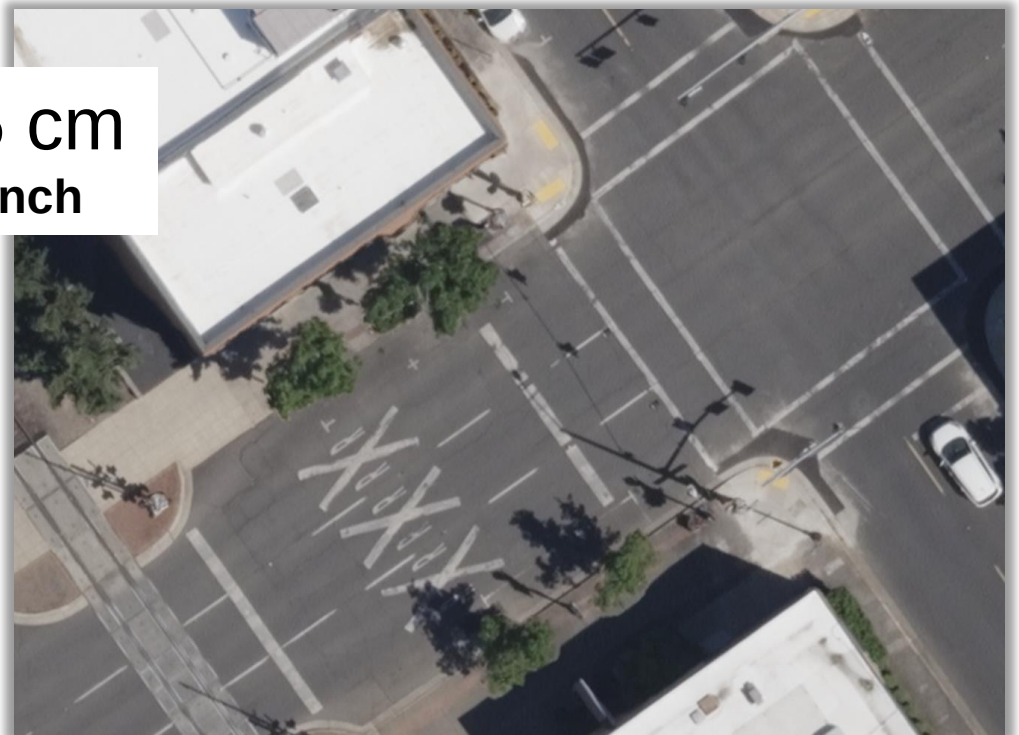


30 cm
12 inch



15 cm
6 inch

Vexcel

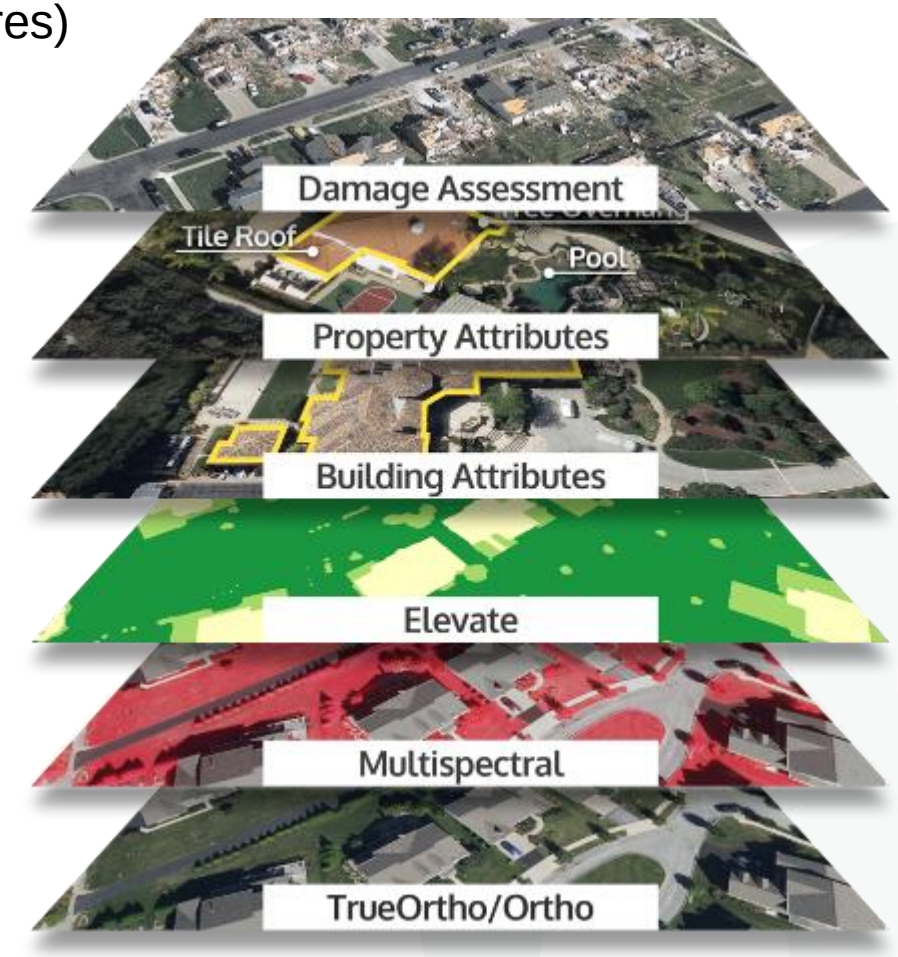


7.5 cm
3 inch

About Vexcel

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

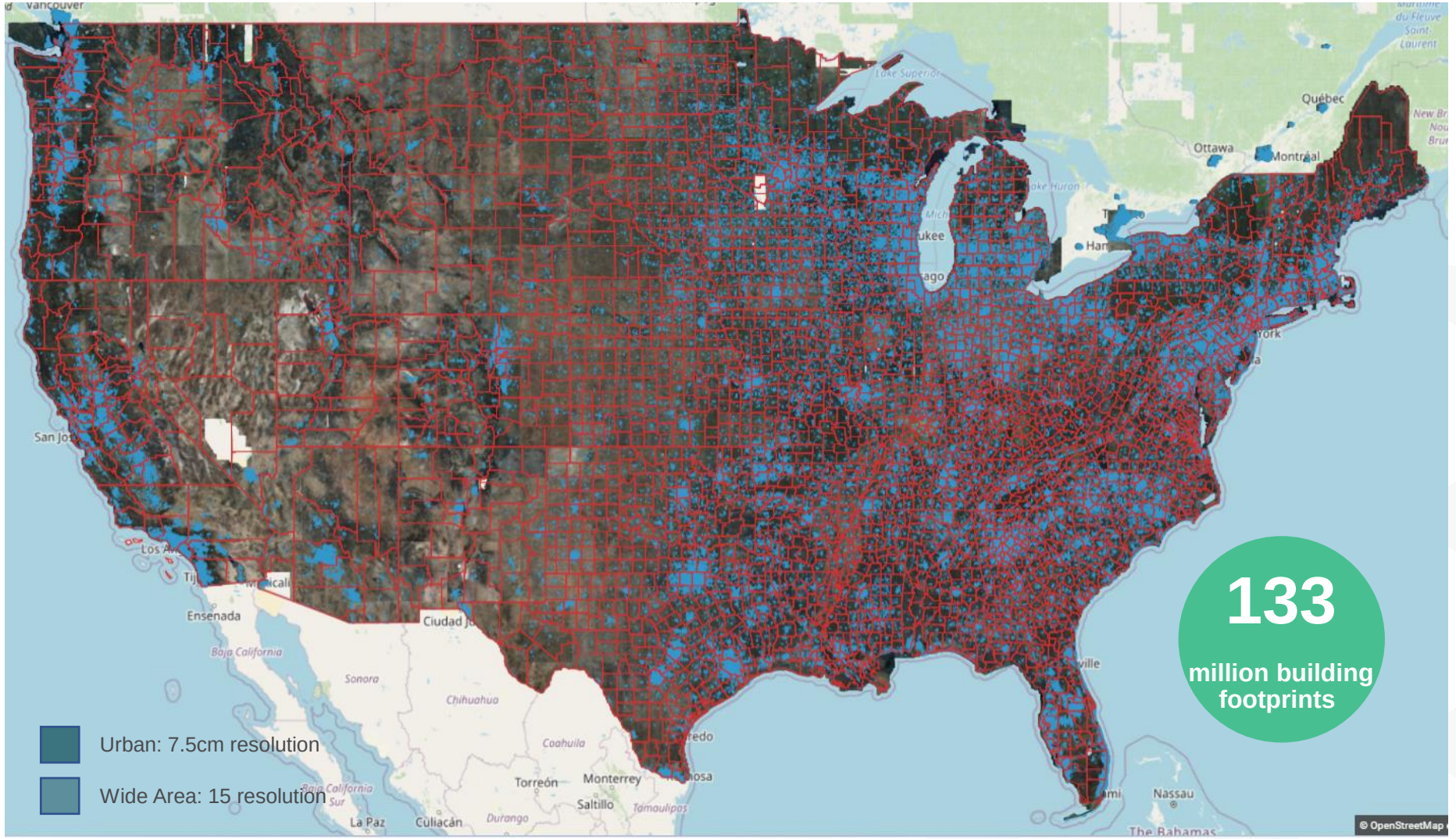
Vexcel Data Program



Vexcel Fleet

Vexcel Imaging

Existing U.S. Footprint: 3 million sq mi



Largest collection of its kind with:

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

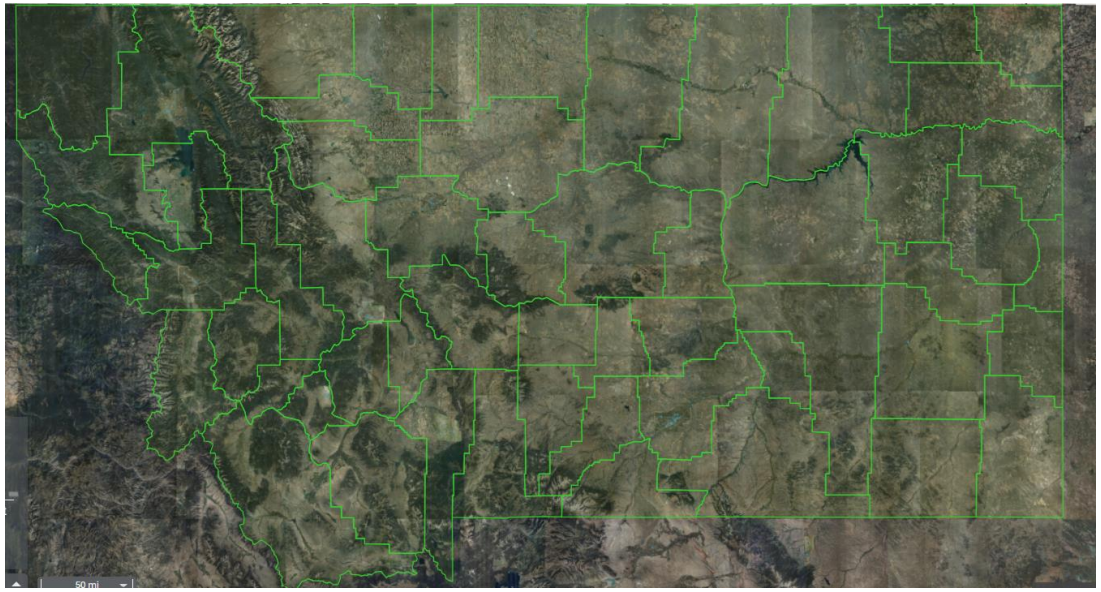
49 states

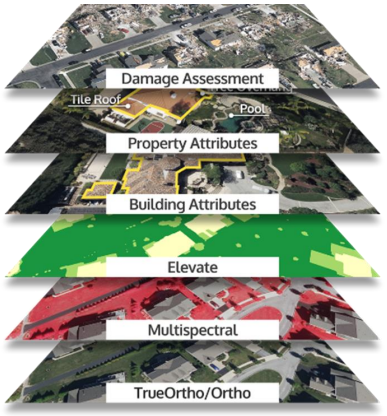
Urban & rural collections

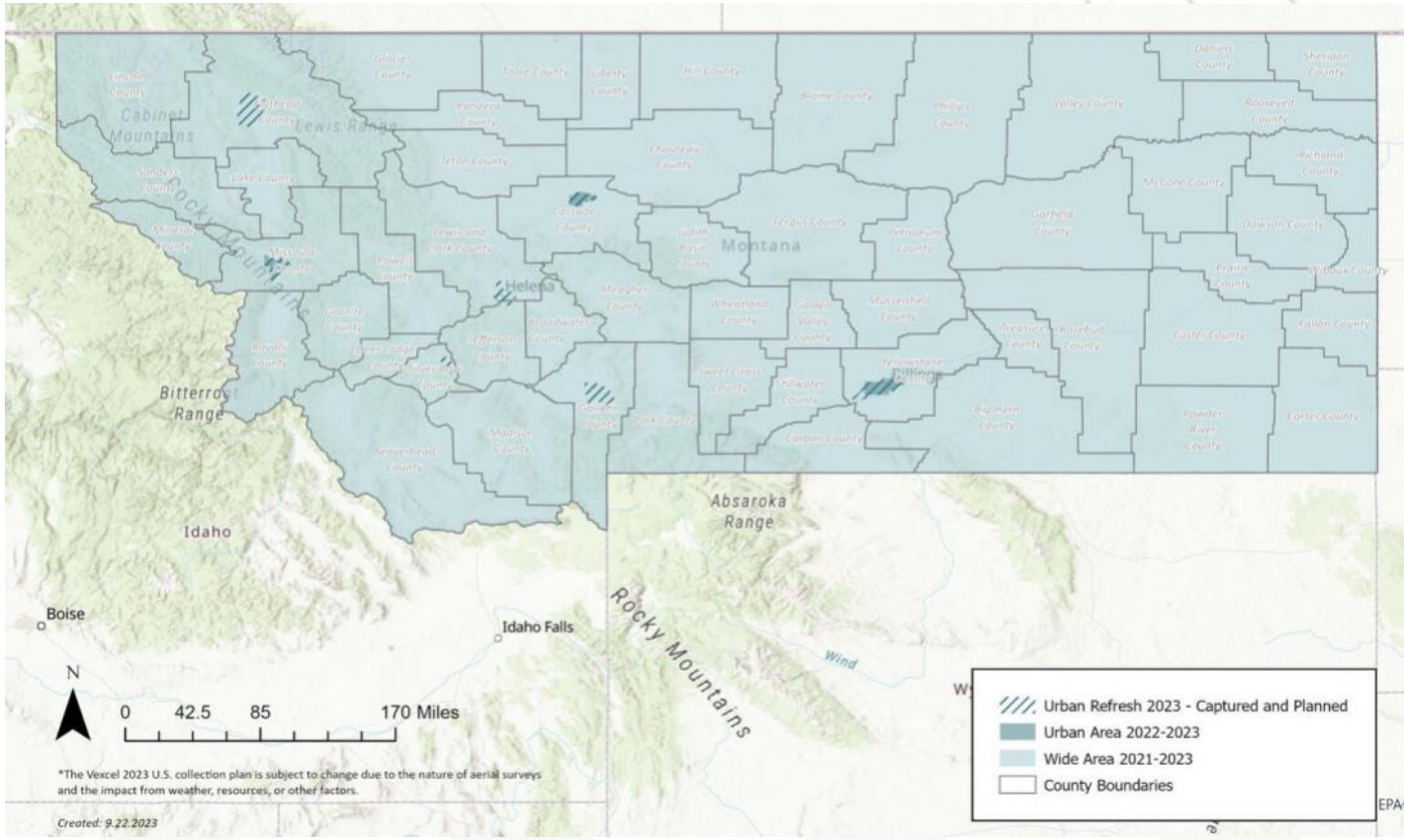
99.6% U.S. population

127 million U.S. households

Current and Historical Imagery & Analytics across Montana

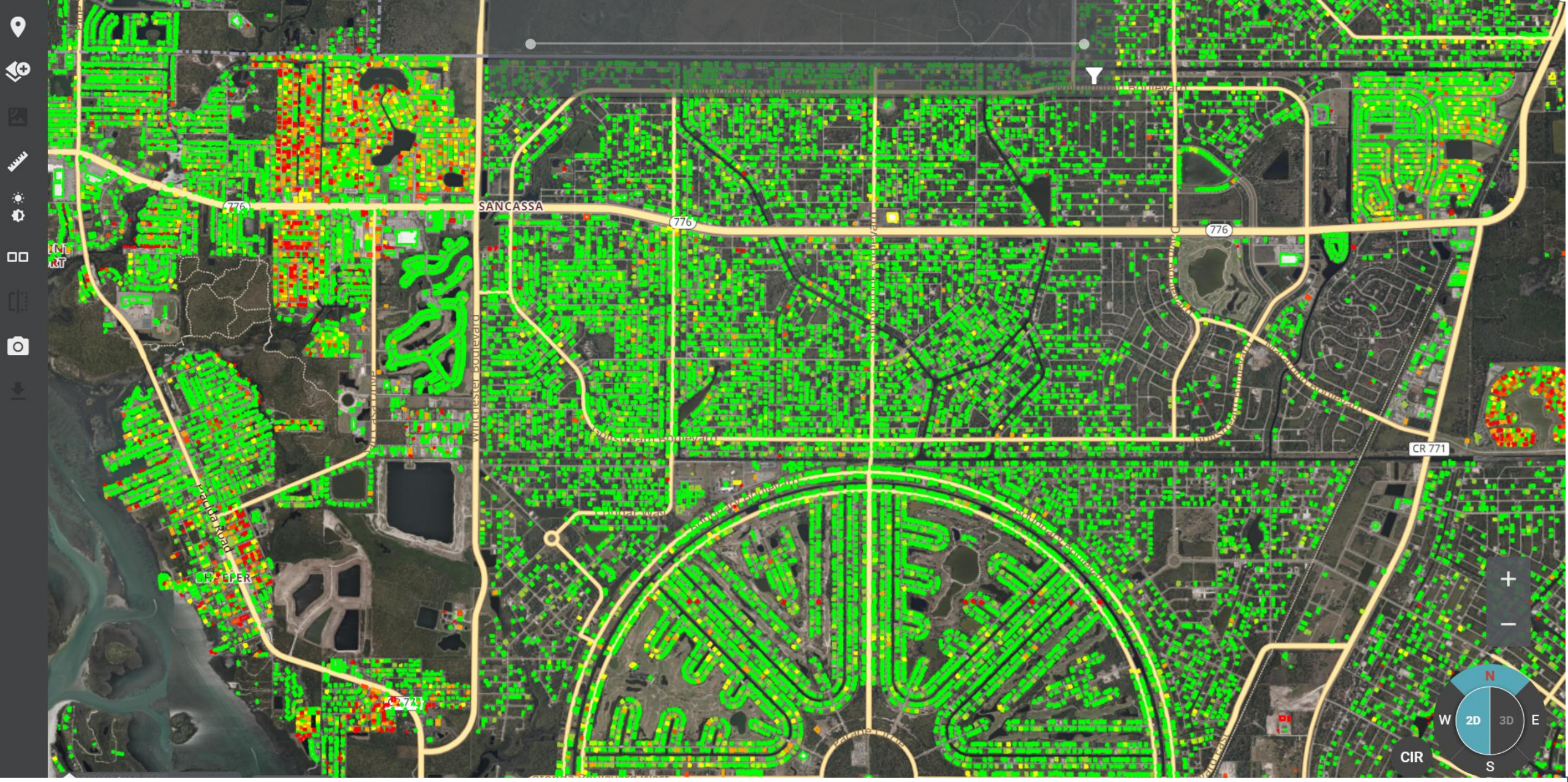






Urban imagery collected 2X per year: 3 inch, 4 Band Ortho, Obliques & DSM/DTMs

Statewide imagery collected 1X per 2 years: 6 inch. 4 Band Orthos & DSMs



Imagine if you could prioritize top issues across your entire State

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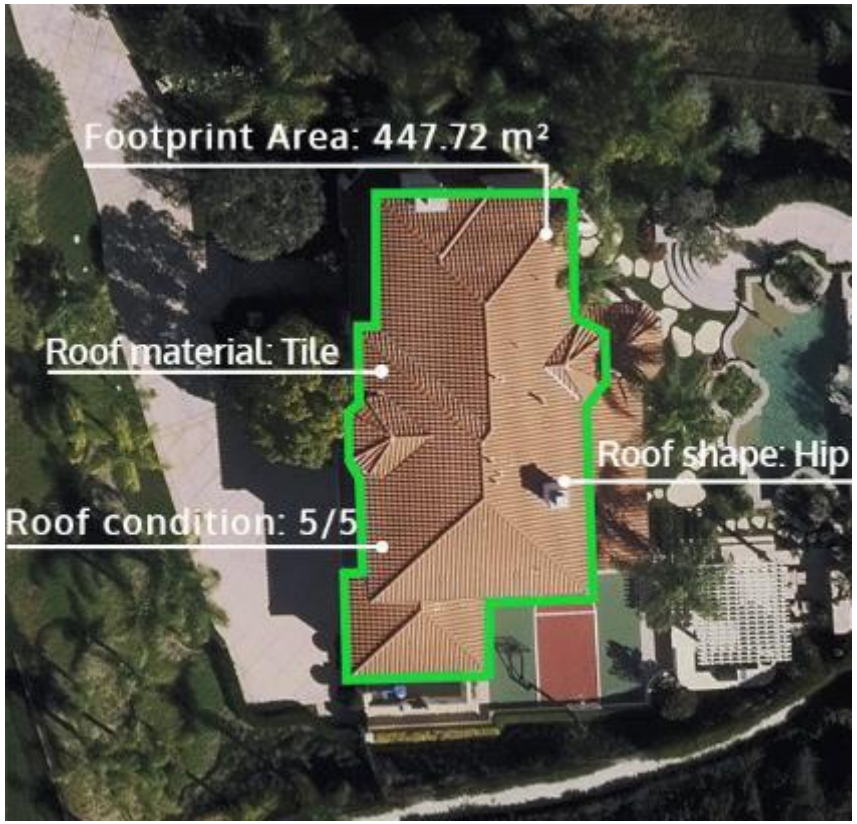
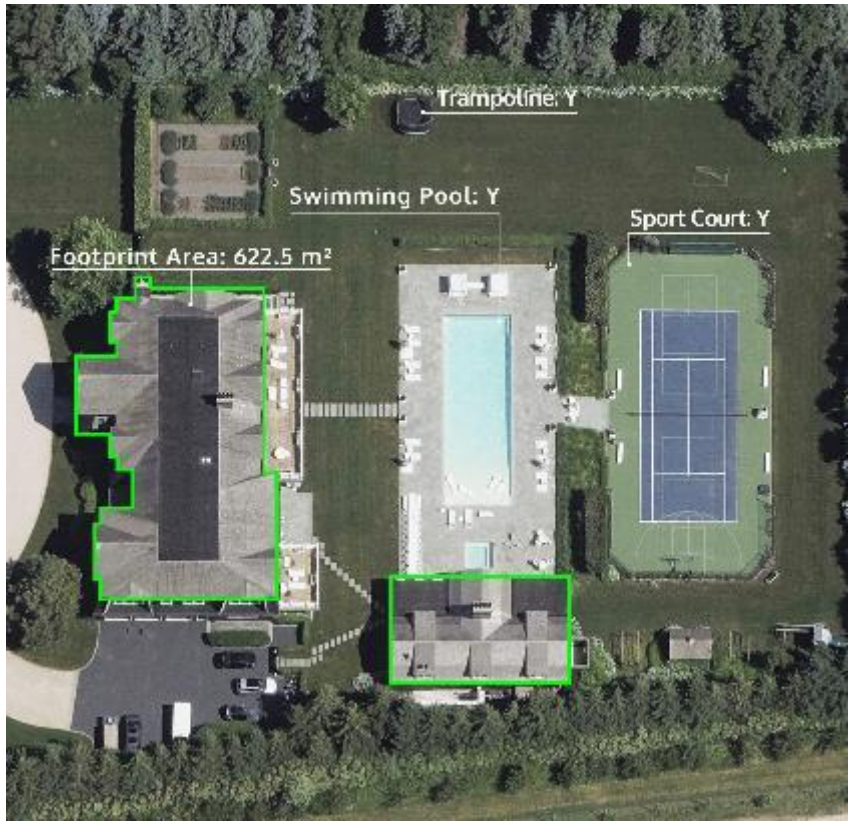
Vexcel Imaging proprietary information. | vexceldata.com

Feature Extractions: Infrastructure, Roadway, Building & Property Elements





Building Attributes

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

Property Attributes

- 20+ attributes, including footprint area, roof condition, solar panels, and pools
- Available for current and historic imagery

Damage Assessment

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

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%

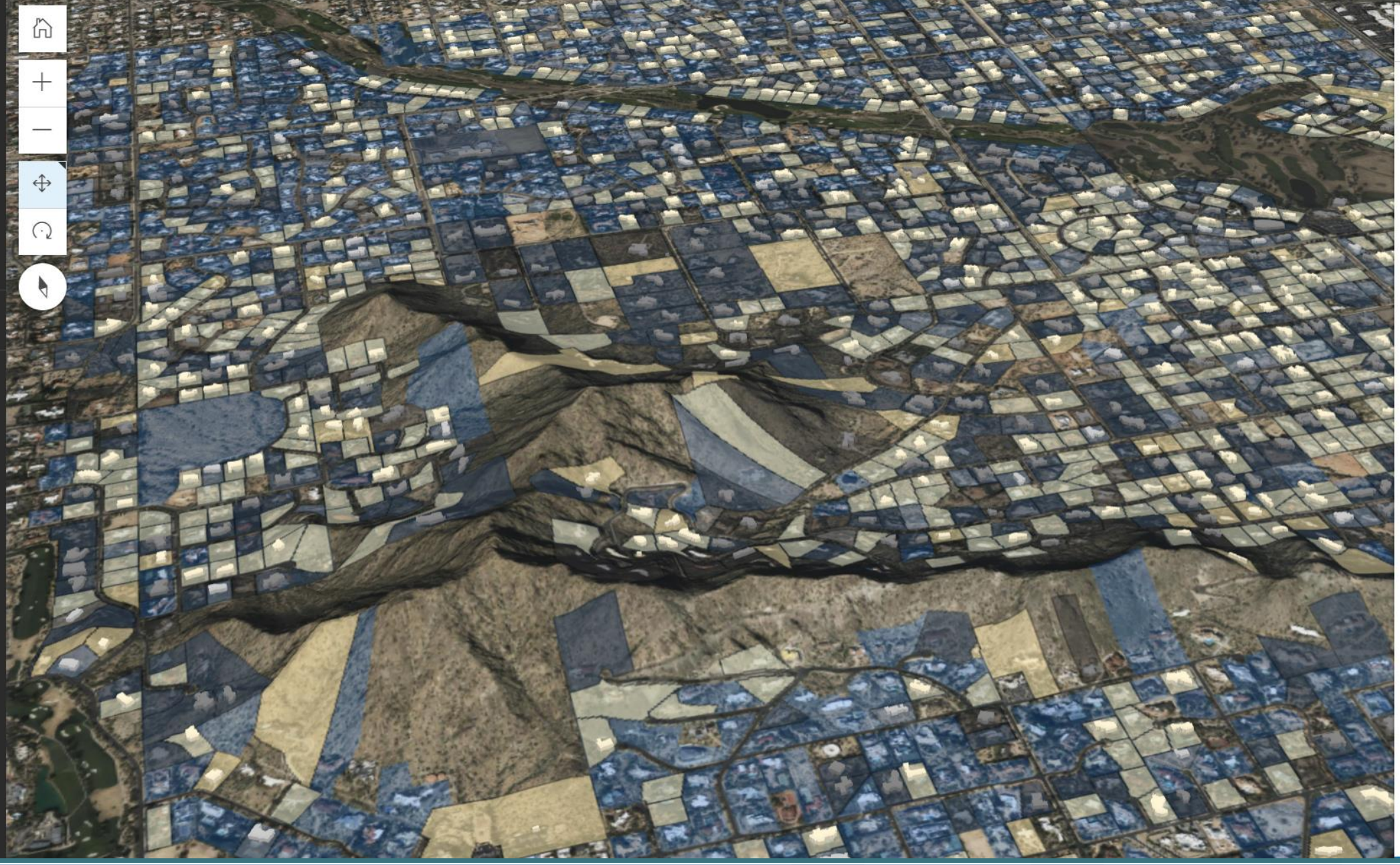
Property Attributes	Value
Pool	Yes – 1013.96 ft^2
Pool: In ground-area	Yes – 908.04 ft^2
Pool: Above ground	No - N/A
Hot tub – area	Yes – 106.99 ft^2
Diving board	No
Water slide	Yes
Deck	Yes
Playground	Yes
Trampoline	No
Sports court	No
Hardscapes	Yes – 5898.62 ft^2
Vehicles: automobile	1
Vehicles: boat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

Primary Defensible Space

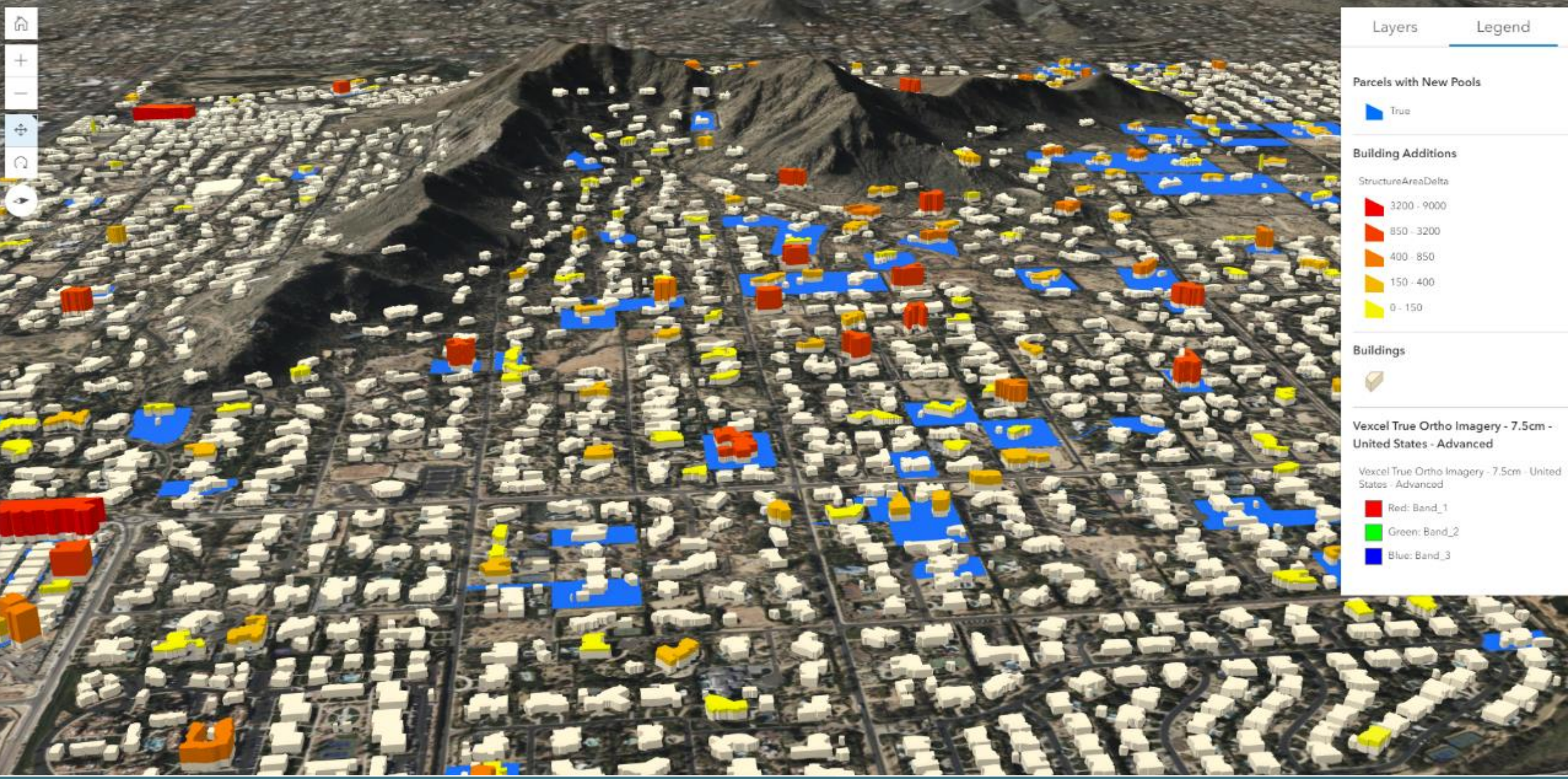
Analysis based on 12 October 2022 imagery

Defensible Space	Value
DSB 5 ft	0%
DSB 30 ft	0%
DSB 100 ft	13%
DSB 200 ft	14%
DST 5 ft	9%
DST 30 ft	9%
DST 100 ft	11%
DST 200 FT	12%

Defensible Space Building: DSB
Defensible Space Trees: DTS
Metrics above relate to 5, 10, 30 100, and 200 foot buffers for both buildings and trees; ex: 24% of the 100 foot buffer contains other buildings



Property Change Detection

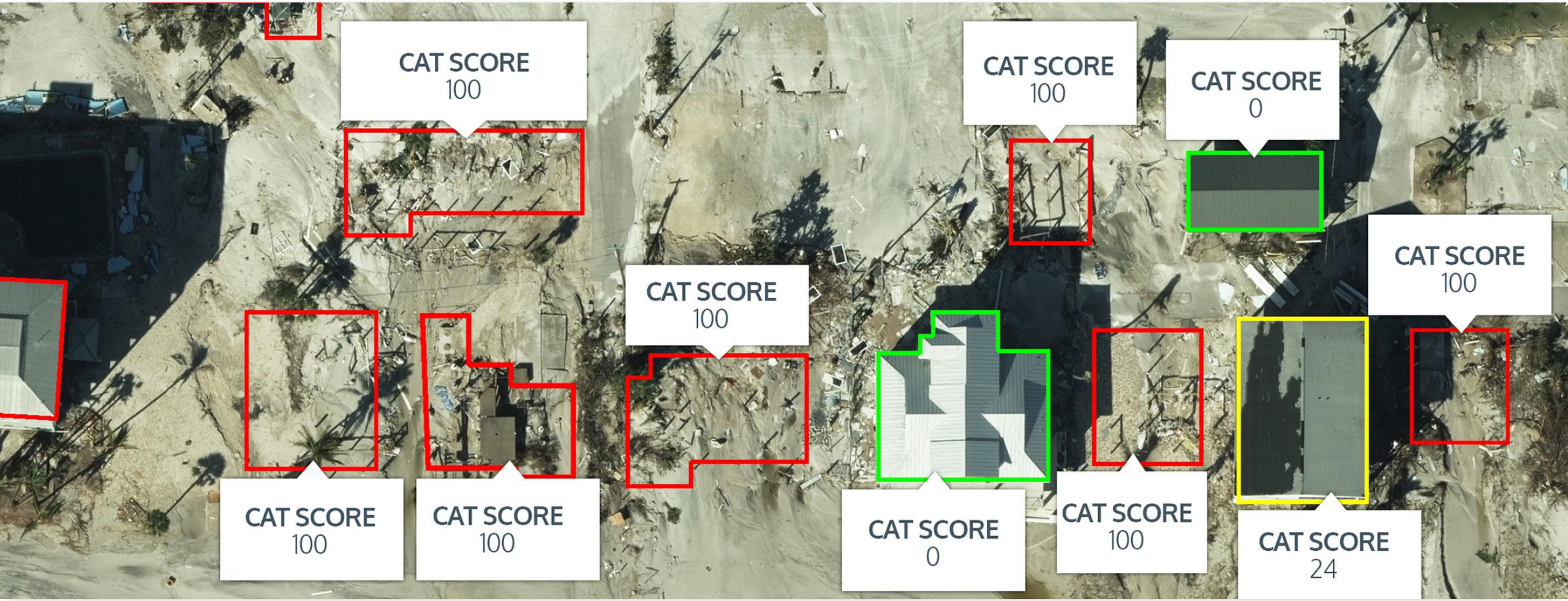


Property Change Detection

Fire Risk Analysis

Damage Assessment for 3.6 Million Buildings

• Automatically generated catastrophe analytics on freshly captured disaster event imagery



Lahaina, Hawaii

Damage Assessment

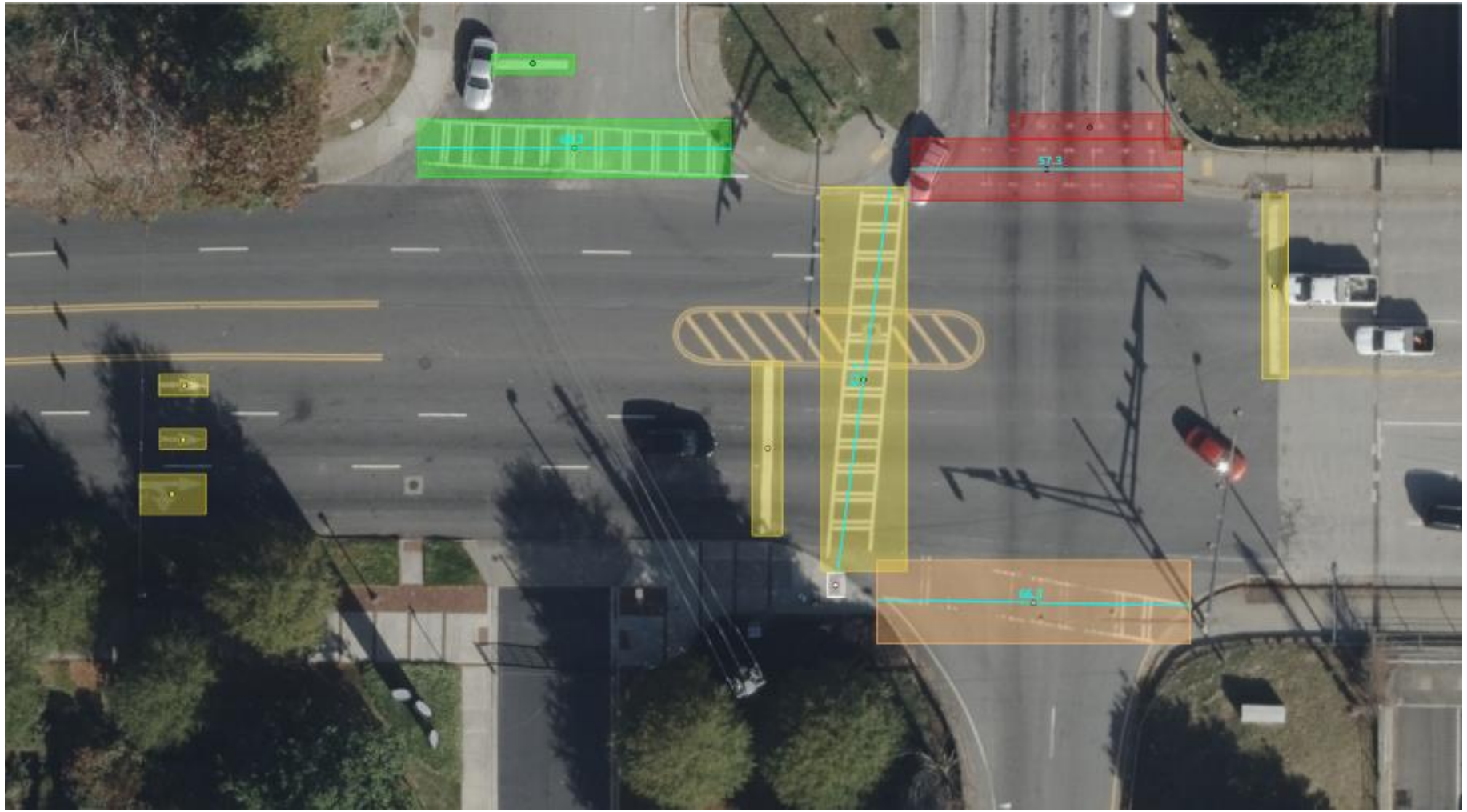
Our AI analysis identified a total of 2,760 structures within our Lahaina collection area.

- **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

Feature Extractions: Roadway Elements



Pavement Markings

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

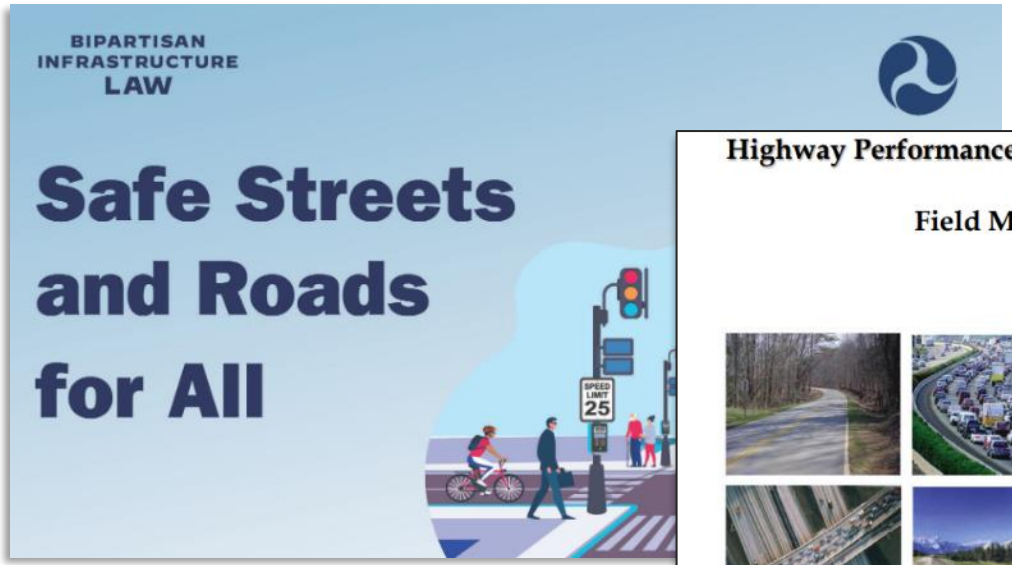
Infrastructure

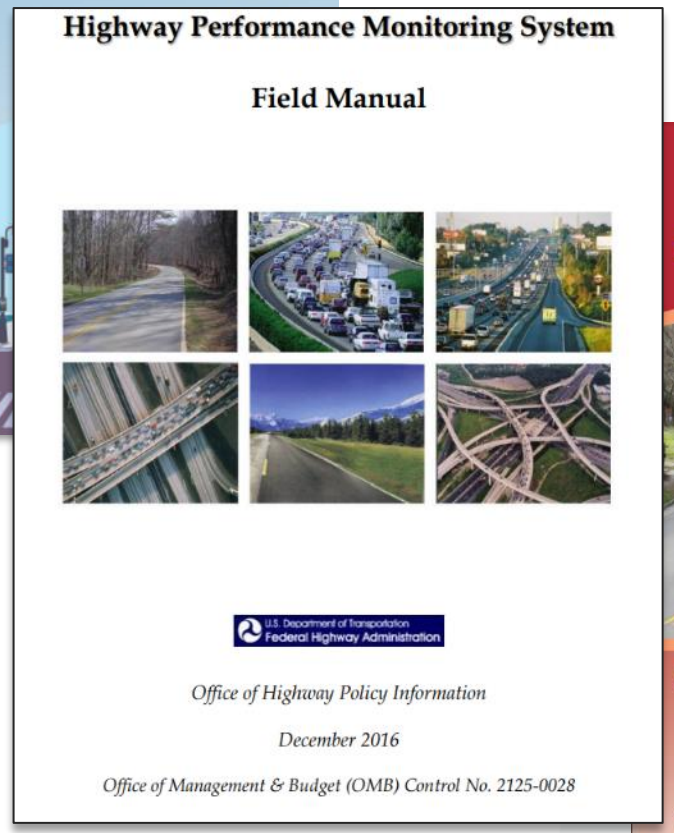
- Pedestrian refuge islands
- ADA truncated domes “curb mats”
- Intersection-junctions
- Available for current and historical imagery

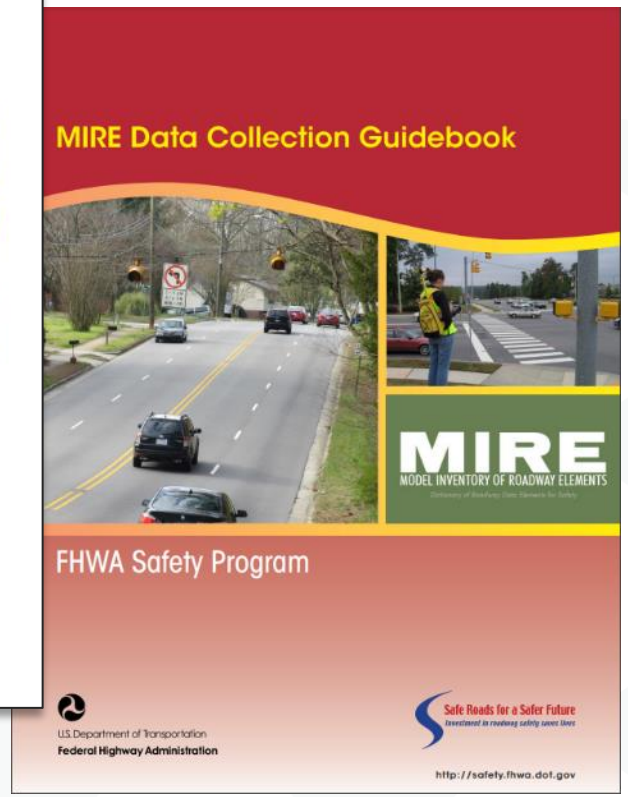
Condition Assessment

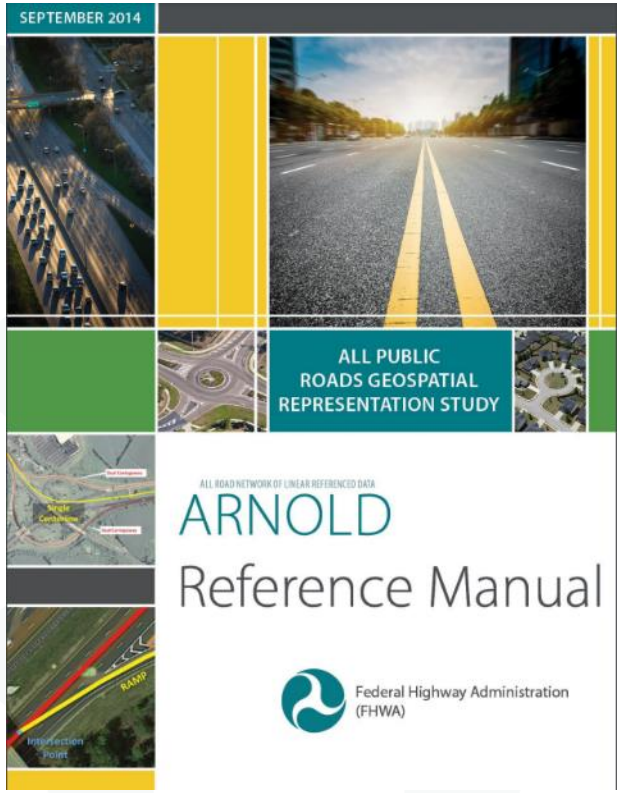
- Pavement marking quality score for prioritizing maintenance
- Available for current and historical imagery

Digitizing Transportation Infrastructure for…

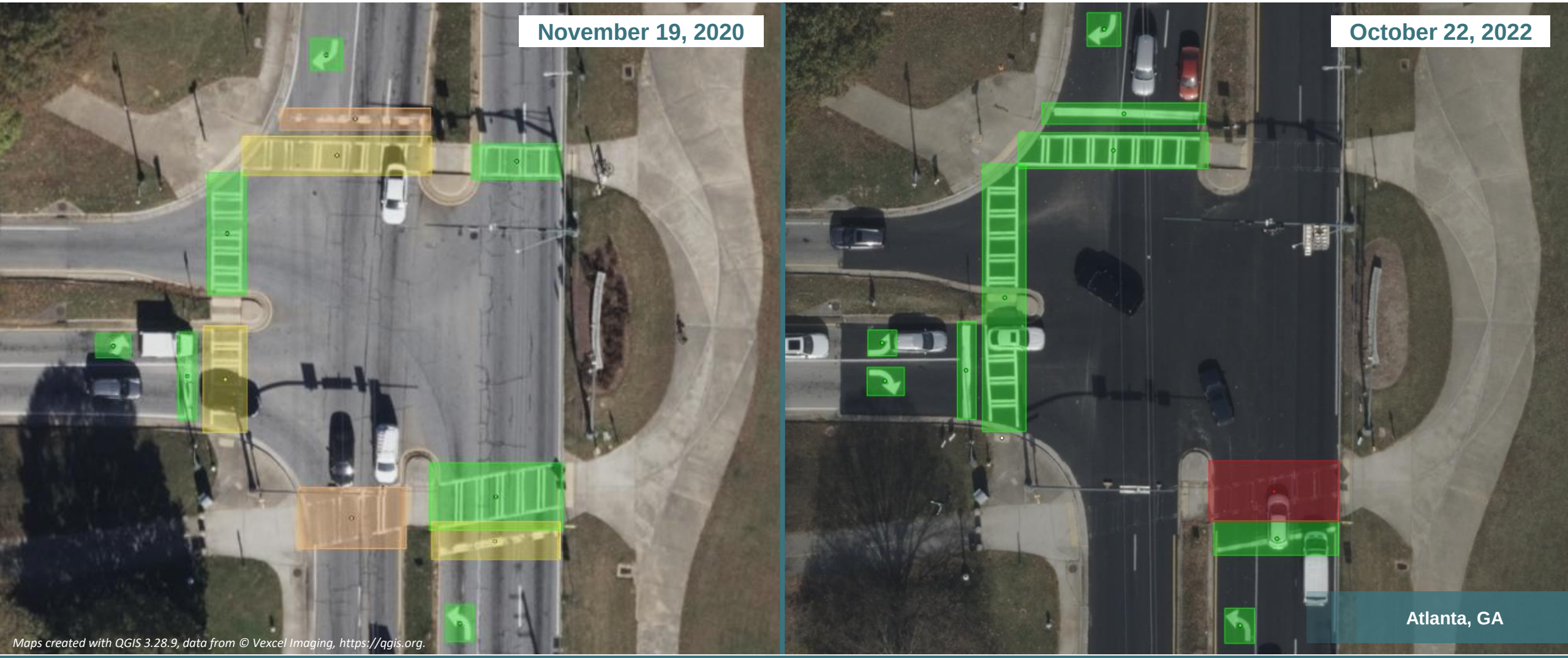








AI/ML Object Detection and Classification



Safety Benefits:

High-visibility crosswalks can reduce pedestrian injury crashes up to:

40% [1]

Intersection lighting can reduce pedestrian crashes up to:

42% [2]

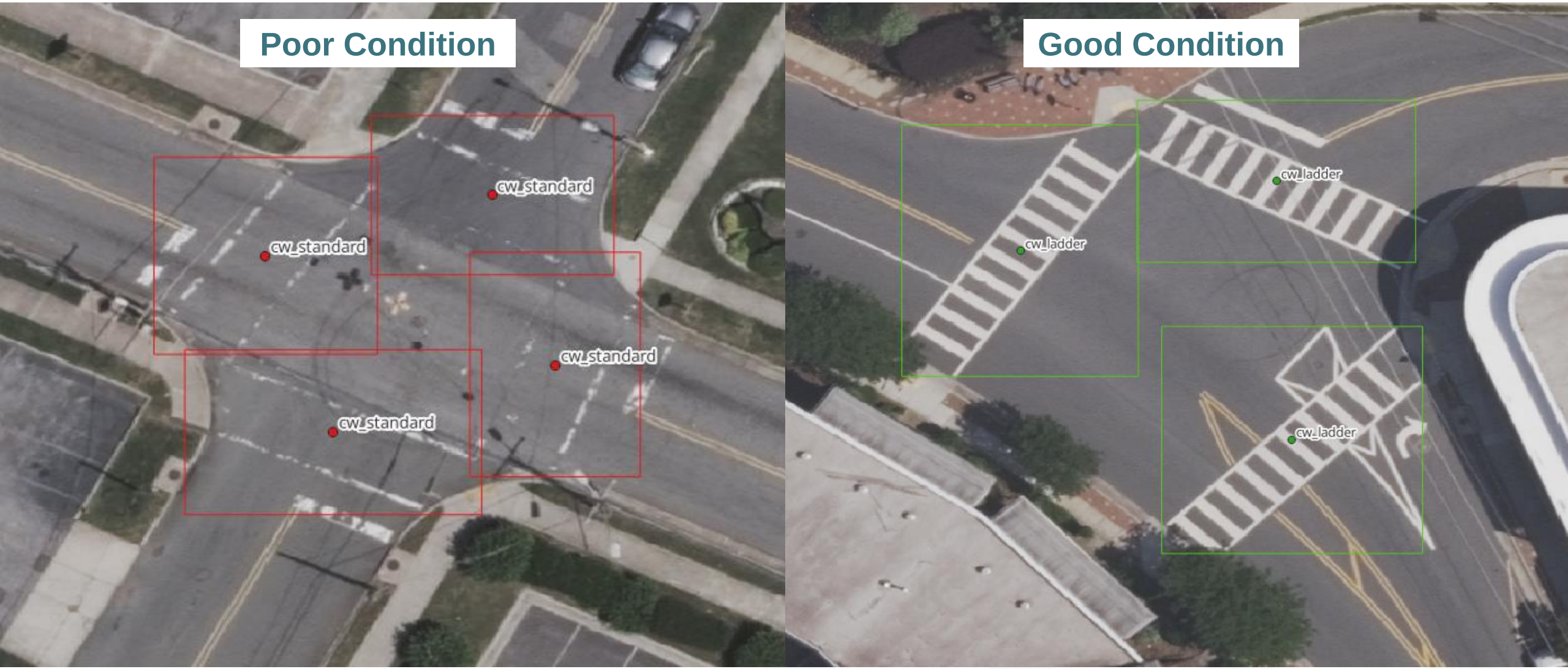
Advance yield or stop markings and signs can reduce pedestrian crashes up to:

25% [3]

U.S. Department of Transportation
Federal Highway Administration

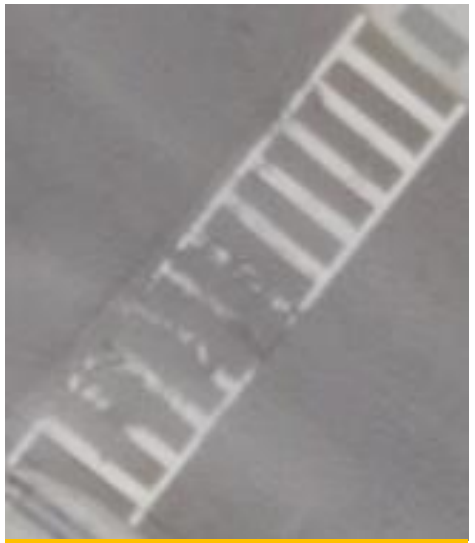
Crosswalk Compliance Assessment: Low vs. High Visibility

Crosswalk Condition Assessment

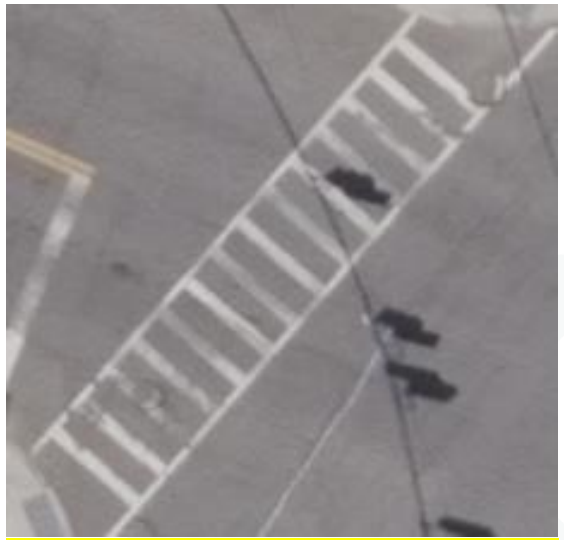


Pavement Condition Scoring

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.

Maintenance Planning – Pavement Markings

Item (Tag)	Count	Poor Condition Count	Replacement Cost (Materials)
stopbar	4235	333	32967
straight_arrow	3848	528	78672
leftturn_arrow	5569	154	26180
rightturn_arrow	1870	81	13770
cw_diagonal	123	3	3000
cw_ladder	396	37	37000
cw_zebra	100	3	3000
handicap_symbol	856	0	0
straightleft_arrow	198	8	2592
cw_solid	219	11	8250
cw_standard	1349	196	88200
leftright_arrow	33	5	850
ONLY_text	419	39	10998
STOP_text	122	10	2550
straightright_arrow	522	37	11988
bikesymbol	459	0	0
merge_arrow	299	8	3696
AHEAD_text	7	0	0
allway_arrow	15	1	447
BUS_text	4	0	0
LANE_text	2	0	0
PED_text	1	0	0
RXR	120	17	8364
SCHOOL_text	138	18	6480
sharedlanebike	122	0	0
SIGNAL_text	2	0	0
text_other	28	1	200
uturn_arrow	12	0	0
XING_text	2	0	0
YIELD_text	6	2	558
Yieldbar	30	3	169.5
	21160	1495	$339,932

Poor condition road markings with quality score of 1 within city limits. Model version 06/07/23

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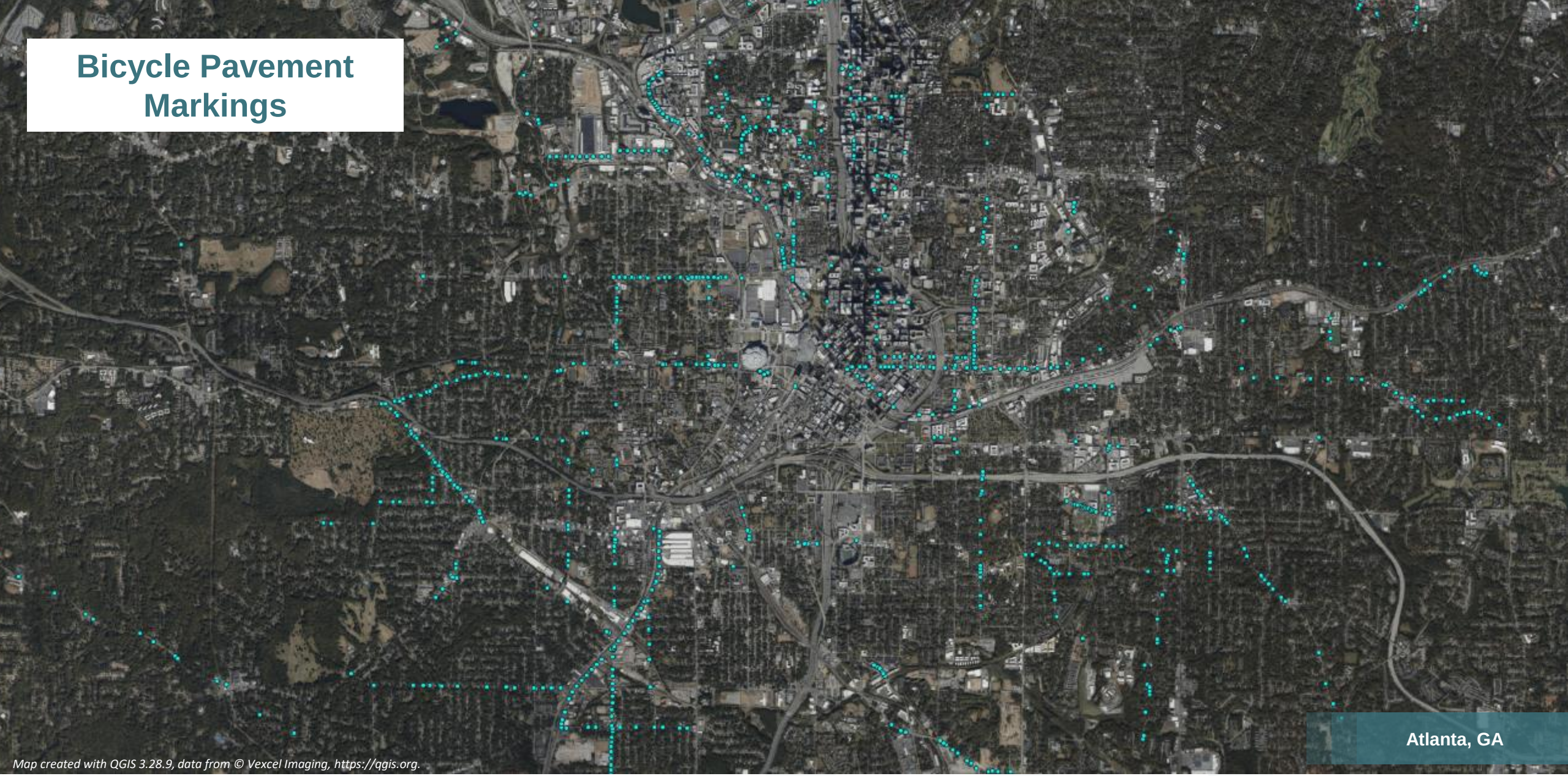
Pedestrian and Bicycle Markings

Atlanta, GA

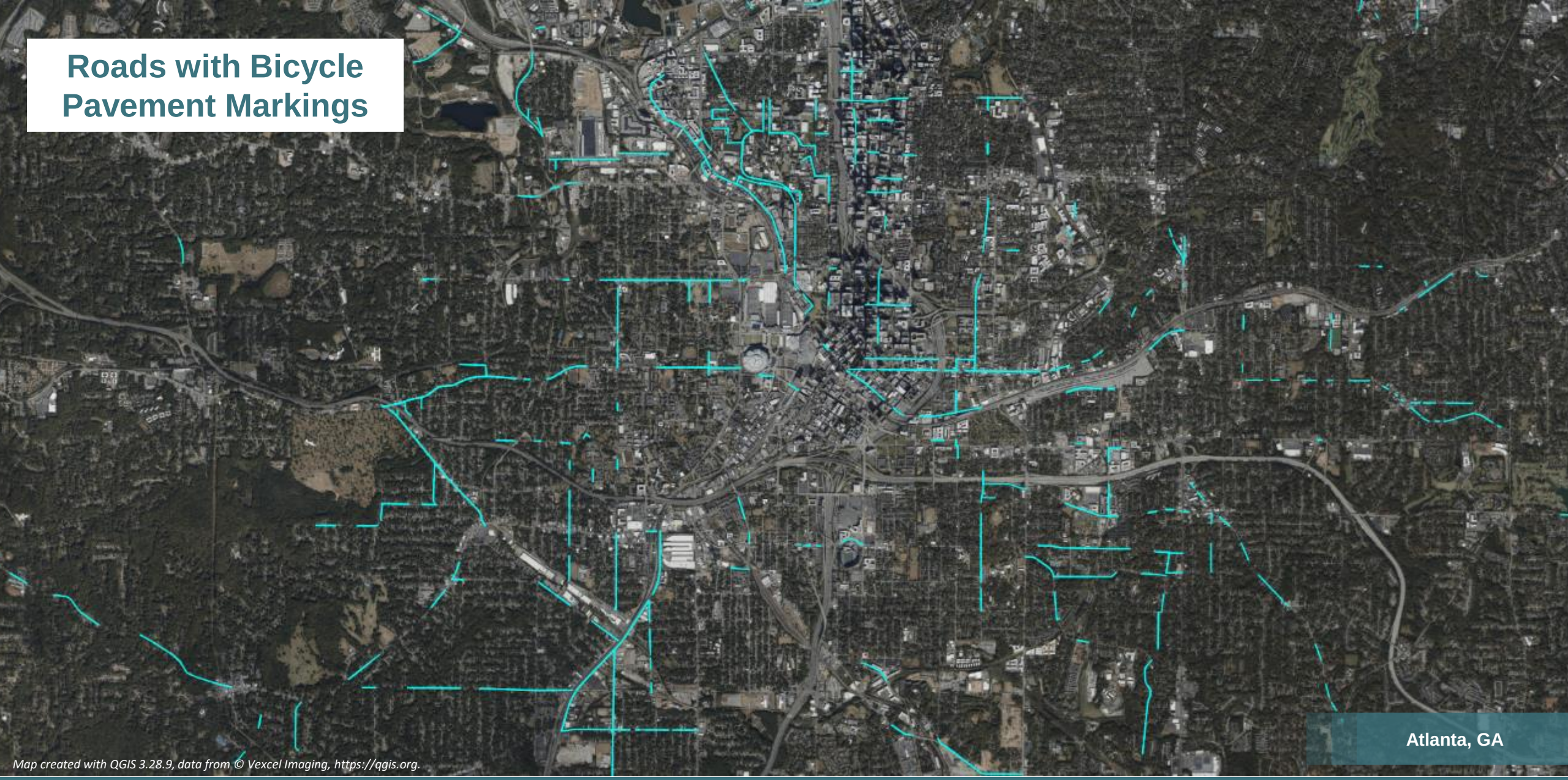
Bicycle Pavement Markings



Atlanta, GA

Map created with QGIS 3.28.9, data from © Vexcel Imaging, https://qgis.org.

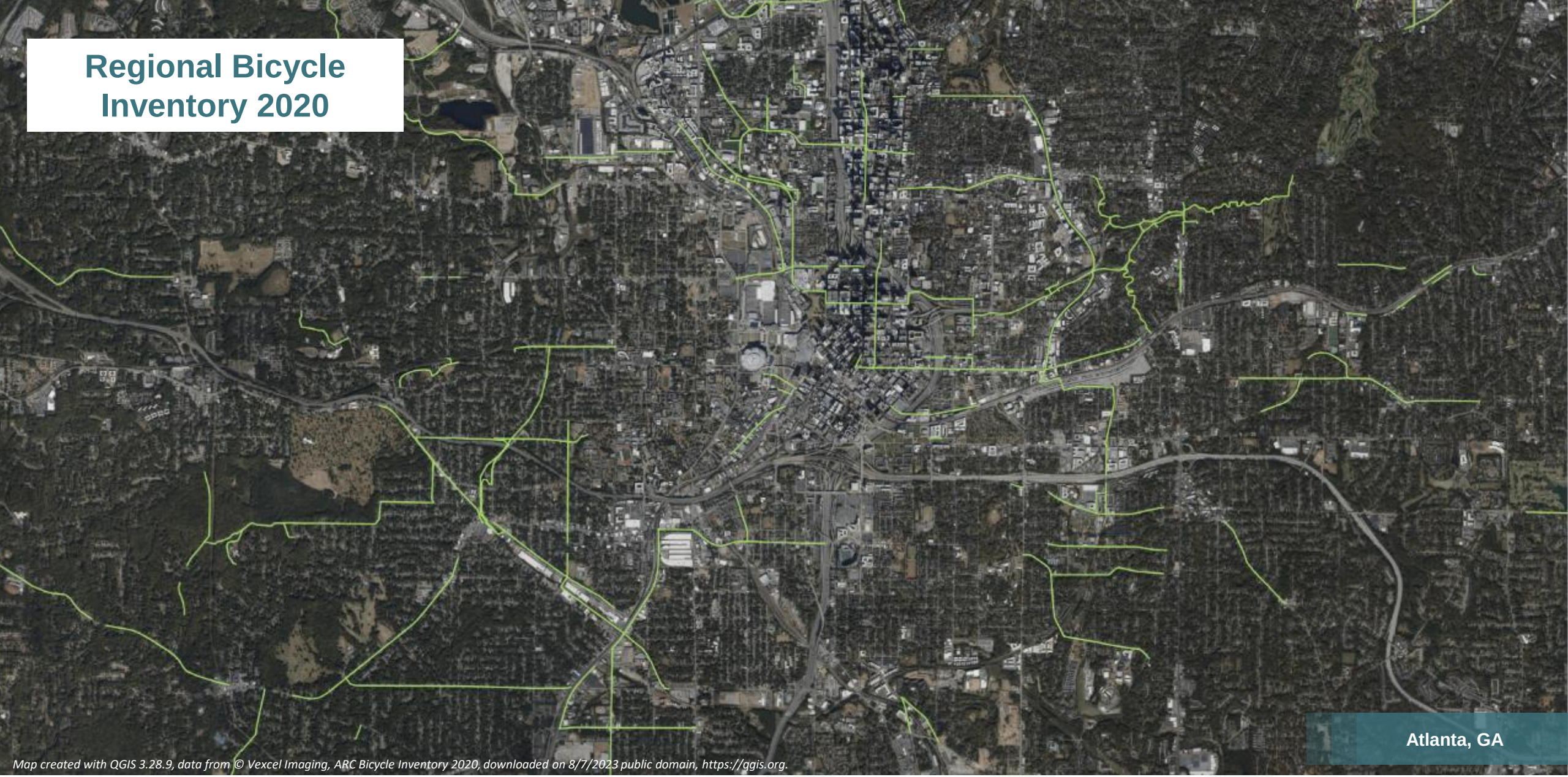
Roads with Bicycle Pavement Markings



Atlanta, GA

Map created with QGIS 3.28.9, data from © Vexcel Imaging, https://qgis.org.

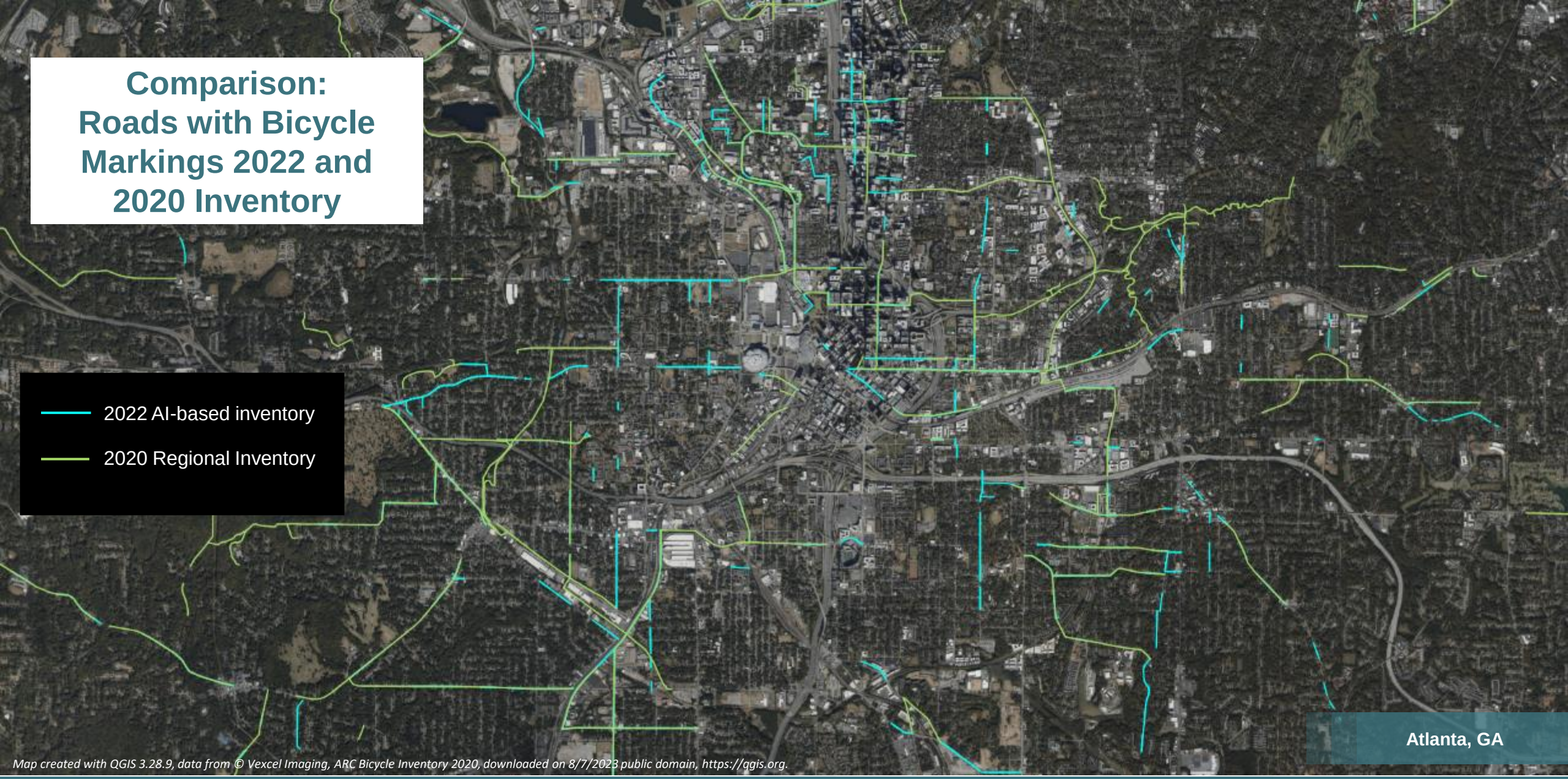
Regional Bicycle Inventory 2020



Atlanta, GA

Map created with QGIS 3.28.9, data from © Vexcel Imaging, ARC Bicycle Inventory 2020, downloaded on 8/7/2023 public domain, https://qgis.org.

Comparison: Roads with Bicycle Markings 2022 and 2020 Inventory



Map created with QGIS 3.28.9, data from © Vexcel Imaging, ARC Bicycle Inventory 2020, downloaded on 8/7/2023 public domain, https://qgis.org.

Roadway Data from High-Resolution Aerial Imagery

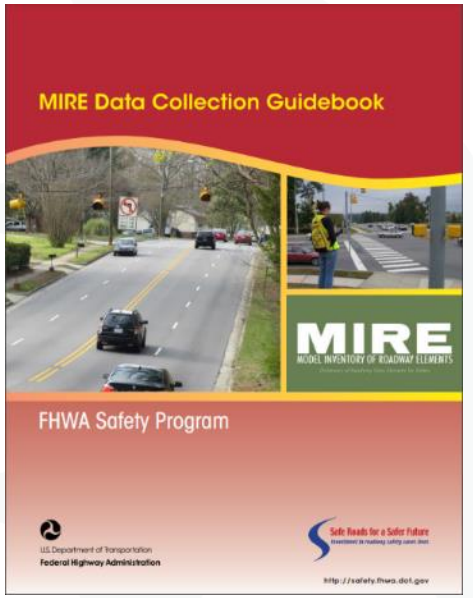
1. **Roadway Inventories for Bike and Pedestrian Facilities**
   - Crosswalks (standard and high visibility) at intersections and midblock
   - Bicycle lanes (symbols, words and green painted lanes)
   - ADA detectable curb mats (truncated dome) and pedestrian refuge islands

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).



[1] https://highways.dot.gov/safety/proven-safety-countermeasures

Statewide Needs

High value source imagery

Mapping grade quality & accuracy

Increased savings

Buy-up options

Tiered Government & Public Access

Standard formats for easy integration

Product Info		Package Items		
		Starter Package	Standard Package	Complete Package
Rural & Urban Blue Sky	6in Wide Area Orthos	✓	✓	✓
	6in Wide Area Derived DTM/DSM			✓
	6in Wide Area Ortho Multispectral	✓	✓	✓
Urban Blue Sky	3in Urban TrueOrthos	✓	✓	✓
	3in Urban Obliques	✓	✓	✓
	3in Urban Ortho	✓	✓	✓
	3in Derived DSM			✓
	3in Urban TrueOrtho Multispectral	✓	✓	✓
	3in Urban Ortho Multispectral	✓	✓	✓
Disaster/ CAT Events Gray Sky	Gray Sky Imagery	✓	✓	✓
	Post disaster property analytics		✓	✓
Elements AI/ML based feature extractions	Building Footprints w/ sq. footage & pools		✓	✓
	Building Attributes			✓
	Property Attributes			✓
	Roadway Attributes			✓
Services, Archives & Data Rights	Historical Data Library	✓	✓	✓
	Connectors (ESRI, WMTS, Map Controls, APIs, Viewer)	✓	✓	✓
	Data viewable in public website views & Government Tier Access	✓	✓	✓
	Professional Services—Vexcel Advocacy	✓	✓	✓

In summary

- Hi-Res Aerials
- 30+ Countries
- Post-CAT Imagery
- Optimized for AI
- Damage Assessment
- Elevation Data
- Property Attributes
- Unmatched Accuracy
- Flexible Memberships
- Building Attributes
- Support Across Property Life Cycle
- API & GIS Integrations
- Top-Class Support
- Partner Network
- Urban + Rural Areas