

Oregon Building Footprints

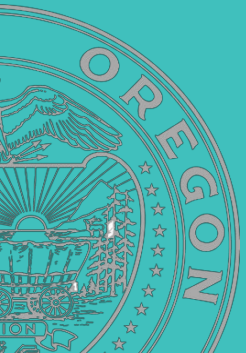
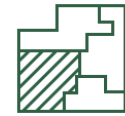
Developing a comprehensive dataset of building footprints

Matt Williams, FIT Co-lead

November 18, 2024

Oregon Framework

16 themes that form the foundation for an authoritative seamless statewide GIS



Addresses and Buildings Theme

- New Theme to the Framework Program
- Formed from Two Related Major Framework Elements
 - Address Points
 - Building Footprints
- Both Need –
 - Standards
 - Statewide Public Datasets
 - Statewide Oregon Address geocoder



Presentation Overview

Background

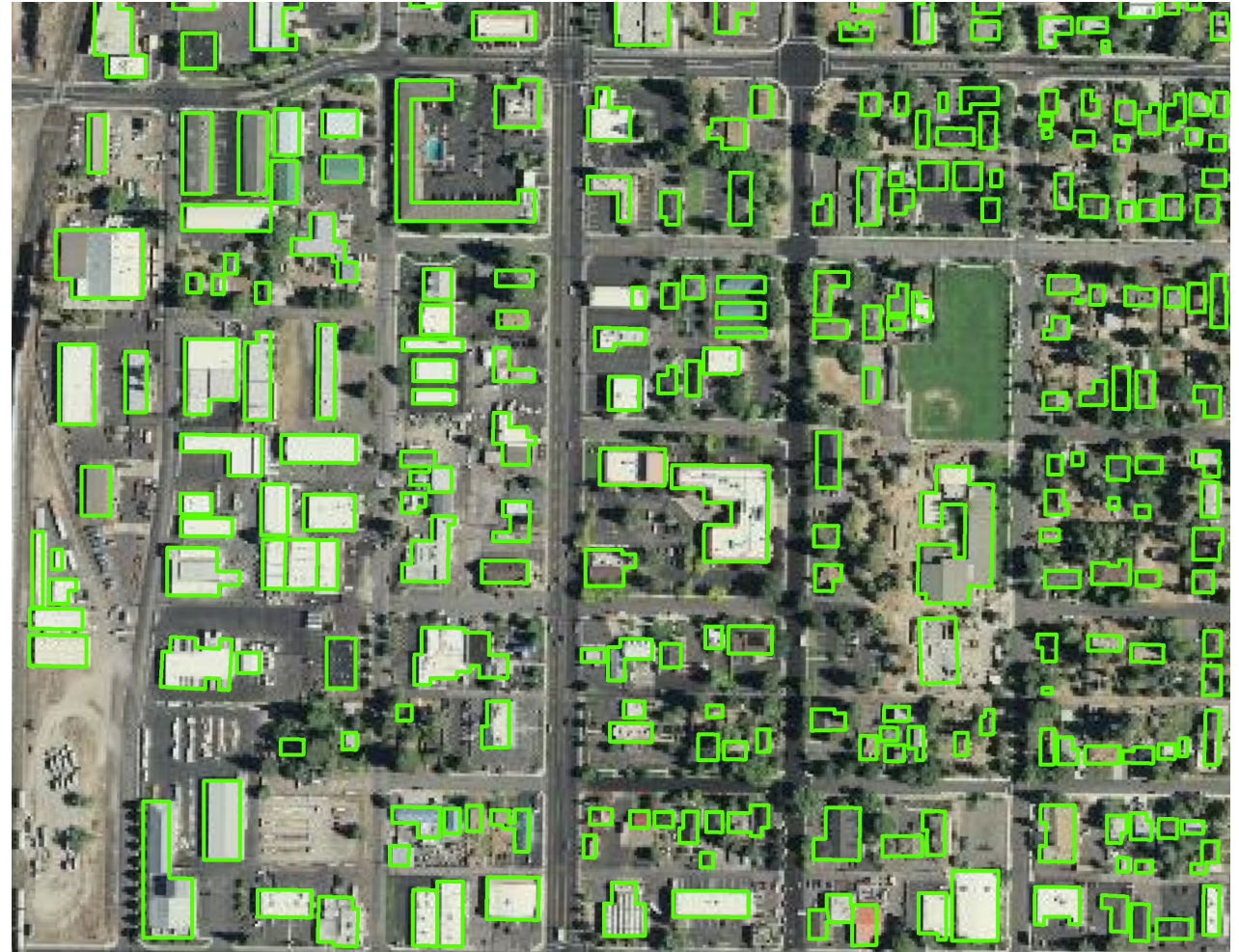
- Oregon building footprint coverage pre-2021
- Microsoft Bing Buildings

GEO-FIT Project

- Scope of work and deliverables
- Methods and Results
- Data Standard and Maintenance

SBFO Future updates

- Identified problems
- Ideas going forward



Addresses and Buildings Theme



Benefits of developing building data

- Natural hazard risk assessments and mitigation
- Community planning & development
- Emergency response and evacuation modeling
- Post-disaster debris management
- Enhanced base map visualization
- Asset management
- Demographic and social vulnerability analysis



*FEMA performing damage assessment in Arkansas
Credit: Win Henderson, April 13, 2009*

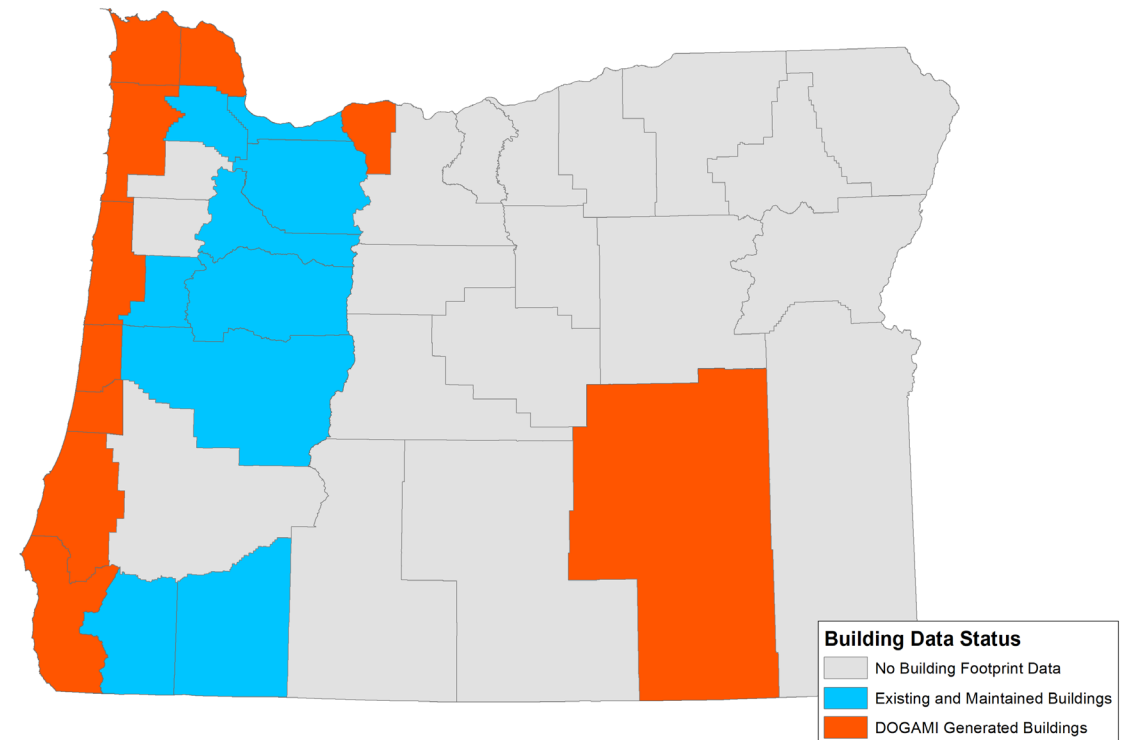
Addresses and Buildings Theme



Oregon Buildings Pre-SBFO

- Building footprints maintained by some county and regional planning agencies.
- Lidar-derived building datasets maintained by DOGAMI
- Microsoft Bing automated building footprint generation for the U.S.

PRE-SBFO BUILDING COVERAGE IN OREGON

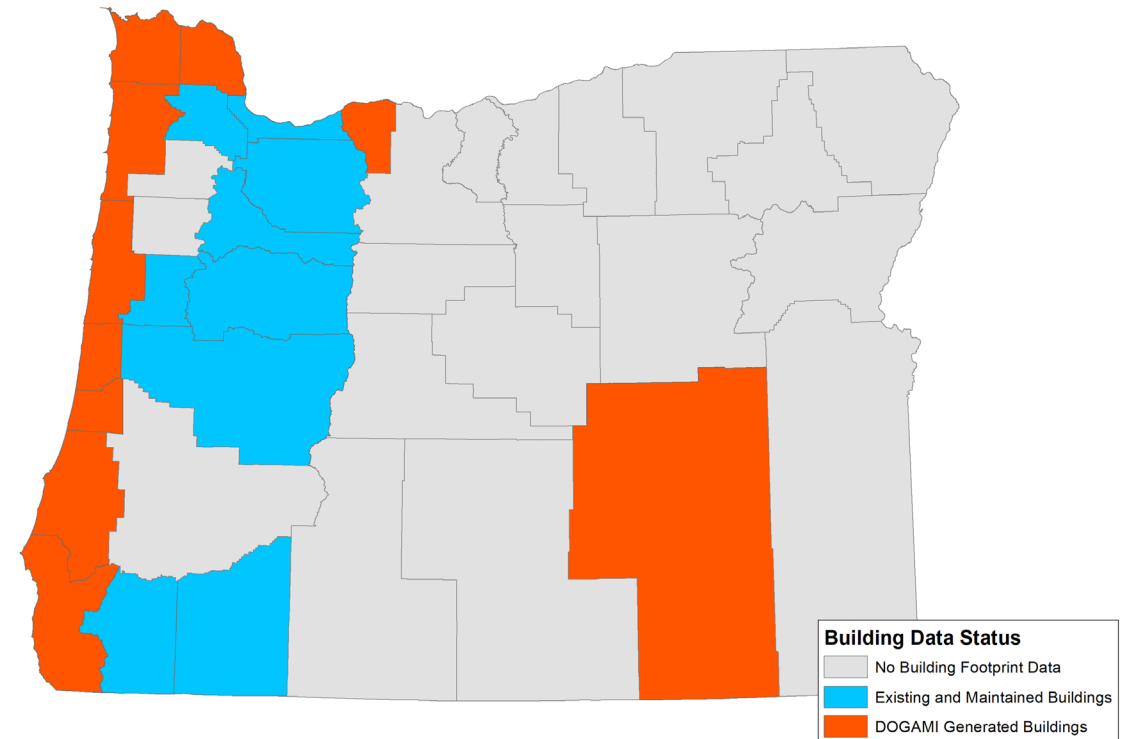


Building Inventory

- Total number of buildings in Oregon – ~2.5 million
- DOGAMI building footprints (coastal portions of Oregon) – ~175,000
- Metro building footprints – ~620,000
- Jackson County building footprints – ~169,000
- Josephine County (managed by Jackson Co.) – 88,000
- Lane County building footprints (excluding coastal area) – ~130,000
- Linn County building footprints – ~130,000
- City of Salem – ~180,000

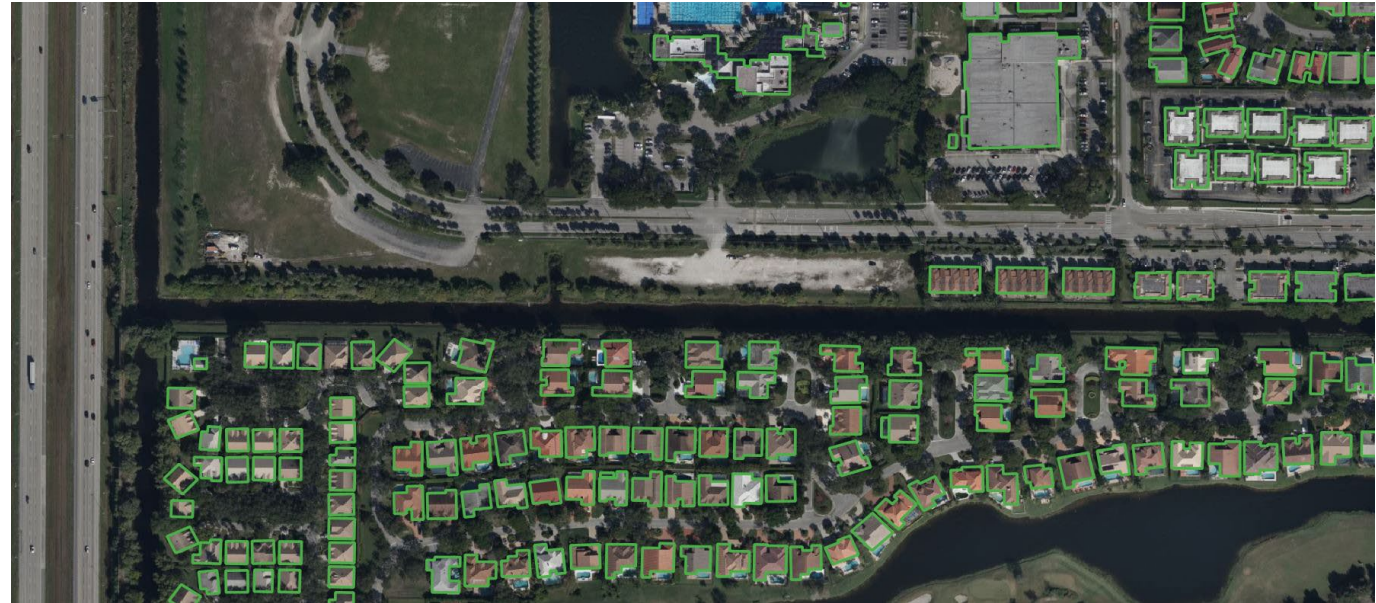
Source: Williams, 2021

PRE-SBFO BUILDING COVERAGE IN OREGON



Microsoft Bing Buildings

- Open-source, nationwide building footprint dataset
- Machine learning process
- Derived from Bing imagery
- Accuracy estimate are 6.3% misidentified and 13% missed buildings (Williams, 2021)
- Errors tend to be missed buildings
- Open-source license



<https://github.com/microsoft/USBuildingFootprints/blob/master/images/example.JPG>

Author: nikolatr

Addresses and Buildings Theme



Intended Goals of the SBFO

- Total statewide coverage
- A compilation of existing datasets
- An edited version of Microsoft Bing buildings
- 2D representation of all “permanent” structures in Oregon
- Based on most recent and best available imagery

Deliverables

- Statewide building footprints GIS dataset
- Metadata for building footprints
- Open-file report documenting methods

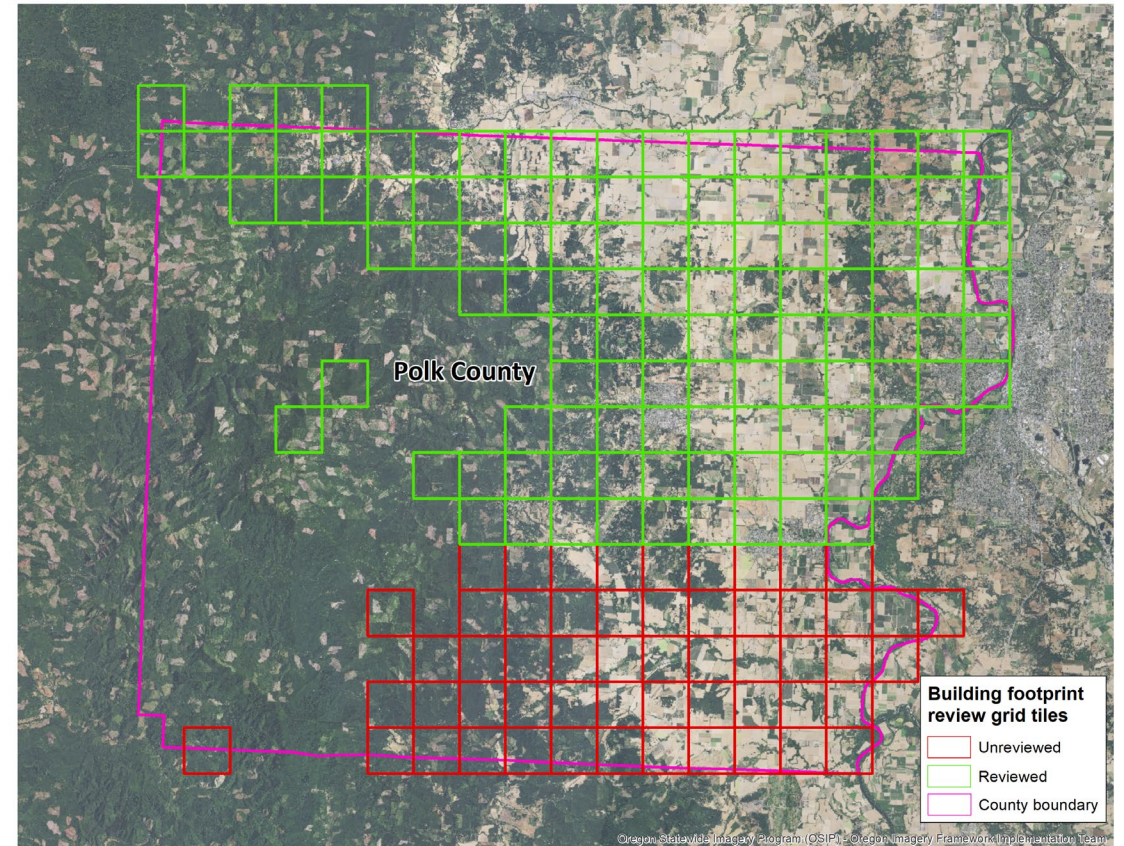


Image source: Wikimedia commons, Jamidwyer, 11/9/2006



Data development

- Regular Workgroup meetings through GEO
- Review and editing the Bing buildings dataset
- Coordination with counties and planning organizations to integrate existing building with the statewide compilation



Source: Williams, 2021



Building Footprints Defined

Buildings defined as...

- Permanent and fixed
- Greater than 400 square feet
- 4-walled roofed structure that people occupy
- Infrastructure not included
- Bus shelters, RV's, non-structural greenhouses (hoophouses), and gazebos not included



Source: Williams, 2021

Addresses and Buildings Theme



Building data development (geometry)

- Deleting misidentified buildings
- Adding missed buildings
- Correcting outline errors (large buildings only)
- Splitting joined buildings (shown in example)



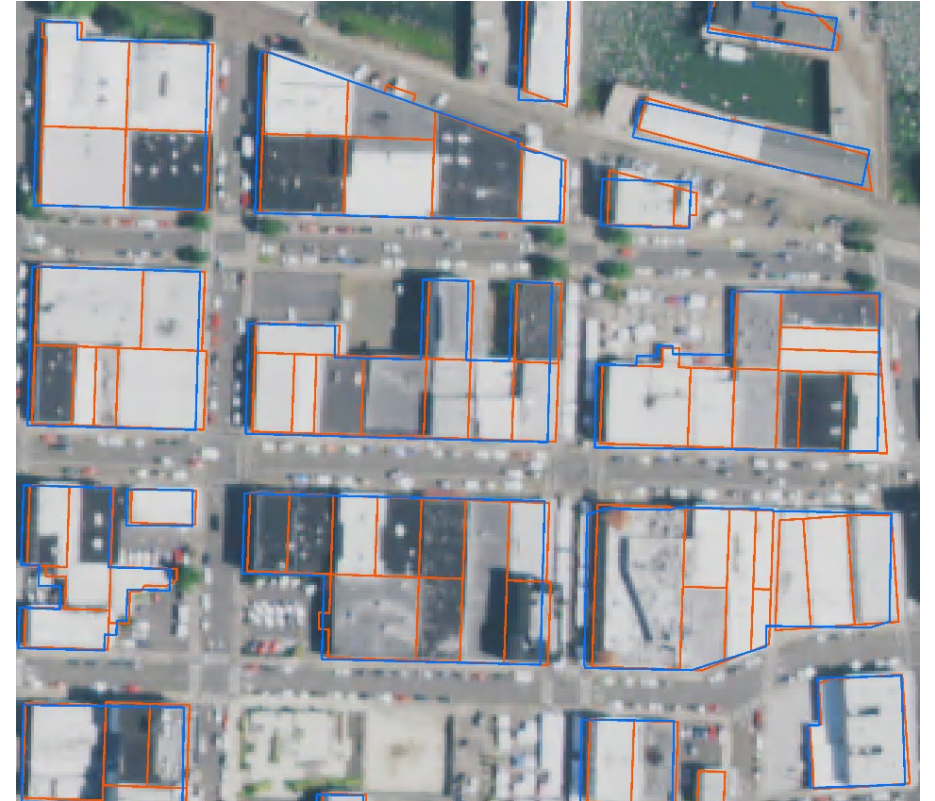
Source: Williams, 2021

Addresses and Buildings Theme



Building data development (attributes)

- Contributor identified
- Data used to generate building (source, source type, source date)
- Building elevation, roof height (derived from lidar)
- Date of review and imagery
- Also: square foot, year built, county, unique ID



Source: Williams, 2021

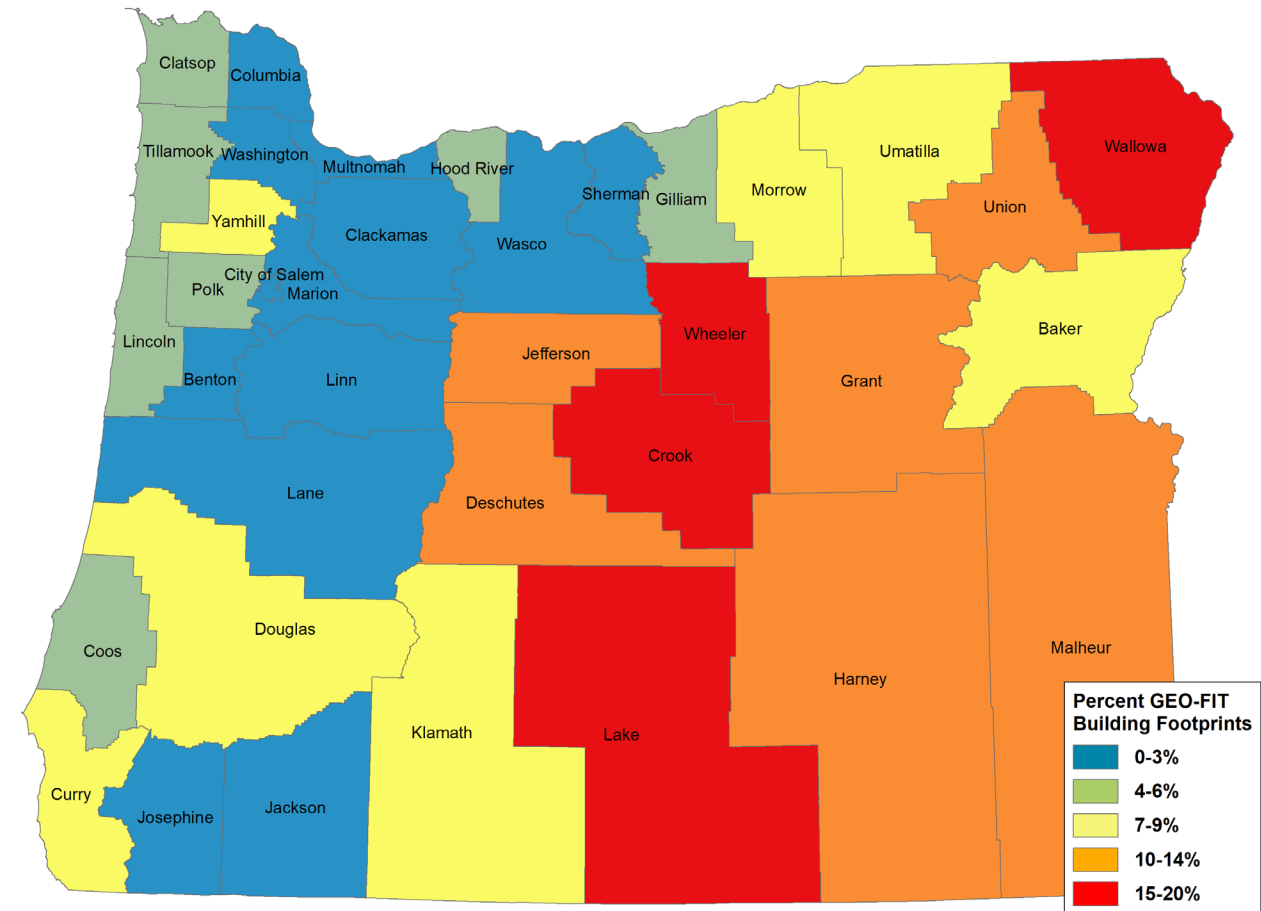
Addresses and Buildings Theme



Results and Findings

- Total number of buildings in Oregon: 2.2 million
- Total number of buildings digitized through GEO-FIT project: 71,424
- Total number of building edited by GEO-FIT: 287,587
- 6.3% commission error and 13% omission error (Bing blds)
- Data quality strongly dependent upon regular maintenance
- Accuracy differences also attributed to lidar vs orthoimagery and vintage of imagery used to generate buildings.

Percent new buildings generated from GEO-FIT project



Source: Williams, 2021

Addresses and Buildings Theme



Identified Problems

- ***No Data Standard***
- ***More useful attributes (e.g., occupancy type)***
- Frequent maintenance necessary to keep up with new development
- Availability of new imagery to verify buildings
- Connecting to related datasets
- Maintaining persistent building IDs through an update



No Building Data Standard to Follow

- Pros and Cons with no existing data standard
- No guidelines to assist us in the decision-making process
- We have a clean slate to work
- Free to customize a standard that will work for Oregon's data needs
- Can make it as complicated or simple as we need



SBFO Data Standard Improvements

- Currently the SBFO is “metadata” based
- Leveraging expertise and identifying needs through FIT Workgroups
- Coordination with city and county stakeholders
- Occupancy type/Use type would be most valuable attribute
- Fixed ID for existing buildings
- Need available taxlot to tie related datasets together

Attributed Building Footprints



Source: Williams, 2021

Addresses and Buildings Theme



Various Building Footprint Attributes

- Area (not the default geodatabase area)
- County name
- Source (data type, date of source, digitization method, contributor)
- Editor (date of edits, who edited, validation imagery, imagery date)
- Lat/Long
- Elevation (lowest adjacent grade, centroid elevation)
- Height (roof height - min, max, avg)
- Address
- Class/Type (e.g., residential, commercial, public, etc.)
- Year Built
- First Floor Height (typically used for flood risk analysis)
- Stories
- Basement
- Flood (flood exposure)
- Value
- Parcel



Attributes included in U.S. building datasets

	AREA	COUNTY	SOURCE	EDITOR	LAT/LONG	ELEVATION	HEIGHT	ADDRESS	CLASS/TYPE	YEAR BUILT	FLOOR	HEIGHT	STORIES	BASEMENT	FLOOD	VALUE	PARCEL
Alabama																	
Alaska																	
Arizona	X	X															
Arkansas	X	X	X														
California	X	X															
Colorado	X		X														
Connecticut																	
Delaware																	
Florida																	
Georgia																	
Hawaii				X	X	X	X										
Idaho																	
Illinois	X																
Indiana		X	X														
Iowa	X			X		X	X	X			X						
Kansas																	
Kentucky	X	X	X														
Louisiana	X			X		X	X	X				X					
Maine								X									
Maryland			X					X									
Massachusetts	X		X	X													
Michigan	X					X	X	X	X			X					X
Minnesota	X			X													
Mississippi																	

	AREA	COUNTY	SOURCE	EDITOR	LAT/LONG	ELEVATION	HEIGHT	ADDRESS	CLASS/TYPE	YEAR BUILT	FLOOR	HEIGHT	STORIES	BASEMENT	FLOOD	VALUE	PARCEL
Missouri	X		X				X	X									
Montana	X																
Nebraska						X	X	X	X								
Nevada						X	X	X						X			
New Hampshire																	
New Jersey	X																
New Mexico	X																
New York		X	X					X									
North Carolina	X						X	X	X	X	X	X	X	X	X	X	X
North Dakota																	
Ohio																	
Oklahoma																	
Oregon	X	X	X	X		X	X		X								
Pennsylvania																	
Rhode Island	X																
South Carolina																	
South Dakota				X		X	X		X			X					
Tennessee																	
Texas	X		X						X					X	X		
Utah			X					X	X								X
Vermont			X				X	X	X								
Virginia																	
Washington																	
West Virginia																	
Wisconsin																	
Wyoming																	

Addresses and Buildings Theme



Non-Oregon Resources

- Bing continues to develop updated nationwide datasets
- FEMA's "USA Structures" (similar to Bing) developing occupancy types for all states
- Imagery vendors can generate building footprints as a derivative product



Building Footprints Standards - Priorities

- Compare existing building datasets from around US (no current Data Standard)
- Identify needs from other Framework Themes that could be met by buildings
- Identify needs from county and city partners around Oregon
- Identify the priorities for the building elements
 1. Core *Most important or mandatory minimum fields, must be *supplied**
 2. Important *Recommended, can be derived from core*
 3. Useful *Optional or nice to have, can be derived from core or location*
 4. Not important nor relevant
- Add any other necessary fields



Possible Future Updates

- Connecting to GEO and other state datasets (e.g. OEM wildfire damage assessment tool)
- Imagery vendors source of new buildings
- AI generated buildings
- Generate subsets or derivative datasets from SBFO (e.g. critical facilities, state-owned, URMs)
- Downloadable custom extents from HazVu
- Refined data standard and clear data stewardship



PROJECT TIMELINE

Figure 1. Building Footprint Standard Development Timeline

Aug	Sept	Oct	Nov	Dec
Identify participants in workgroup and set up regular meeting cadence	Kick-off, Review current building footprint data, need for standard, timeline and goals/objectives	Develop Proto Standard	Develop Proto Standard	Develop Proto Standard

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Develop Proto Standard	Develop Proto Standard	Finalize Proto Standard for forum and public reviews	Present at 2025 Spring Framework Forum & Open Public Comment Period	Close 30-Day Public Comment Period	Respond to public and forum comments	Prepare Draft Standard for Peer Review	Peer Review	Incorporate comments from Peer Review	Prepare for TAC Review	2-Week TAC Review & Incorporate comments from TAC	Prepare Final Draft for OGIC Endorsement (Jan 2026)
		Begin work on Stewardship Plan					Draft Stewardship Plan			Final Stewardship Plan	

Jan	Feb		
Present Standard at OGIC Meeting for Endorsement	Standard Implementation		Key Milestone (Data Standard)
			Required Review (Data Standard)
			Stewardship Plan

Thank You!

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Framework data is available at:
geohub.oregon.gov

