Viewshed Analysis Using New Buildings and Developments

Downtown Ann Arbor is changing rapidly.
New buildings are rising, and the skyline looks dramatically different than it did just a decade ago

This project explores a simple question:
How can we measure that visual change?
April 21, 2026

Motivation

As a lifelong resident of Ann Arbor, I've watched the skyline transform with increasing development. While these changes are easy to notice, they are difficult to quantify.

Rather than simply mapping new buildings, this project focuses on **visibility**—how new structures change where in the city you can see them.

To answer this, I use **viewshed analysis**, a GIS method that determines where a feature is visible from across the

landscape.

Research Question

How has the Ann Arbor skyline changed, and how can we quantify the increase in building visibility over time?

This project compares historical and modern building heights to determine how much more visible new buildings are today than in the past.

Field Data Collection

To understand where skyline changes are most noticeable, I designed a field data collection mission using ArcGIS Field Maps.

I walked and biked around downtown Ann Arbor, identifying locations where new development significantly altered the skyline.

At each location, I collected:

- A GPS point
- A photo of the skyline or building
- Notes describing the visible change

GNSS and Accuracy

Field data was collected using a smartphone GNSS receiver, which provided:

- ~3–5 meters horizontal accuracy
- ~5 meters vertical accuracy

Because of this limitation, high-accuracy elevation data was required for the analysis.

This level of accuracy was sufficient for mapping observation locations, but not for measuring building heights.

In a higher-budget workflow, survey-grade GNSS or RTK systems could improve positional accuracy, but were unnecessary due to the availability of LiDAR data.

Field Maps Collection

2009 DTM

Elevation Data

To measure building height changes, I used LiDAR datasets from the NOAA Digital Coast portal.

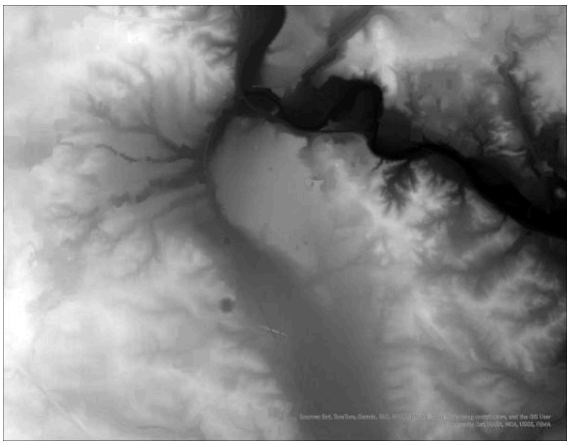
Two datasets were used:

- 2009 elevation model
- 2017 elevation model
- 2022 surface model

These datasets provide highly accurate 3D representations of the city, allowing precise measurement of vertical change.

Identifying New Development

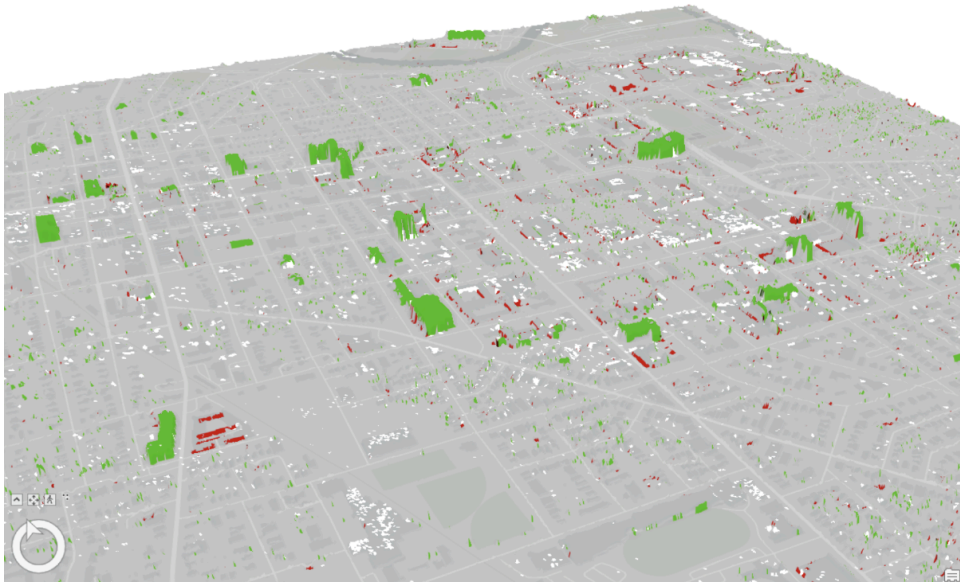
Using raster analysis in ArcGIS Pro, I calculated the difference between the 2009 DTM and 2017 DTM elevation datasets. DTMs were normalized using the DSM.



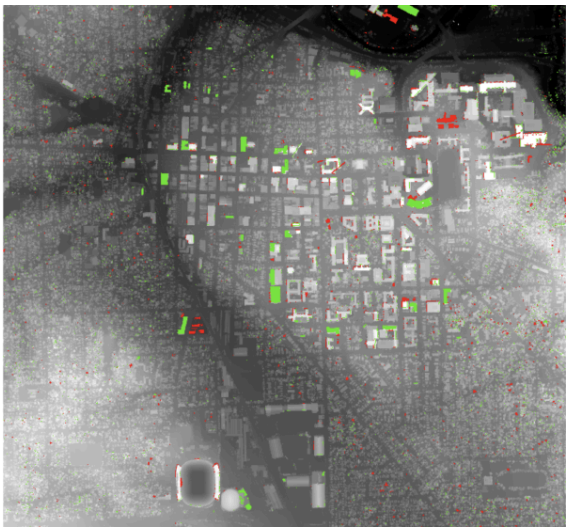
2022 DSM

Areas with more than **40 feet of vertical increase** were classified as new or significantly expanded buildings.

This produced a dataset highlighting major development across downtown Ann Arbor.



3D view of increase in building heights (green)



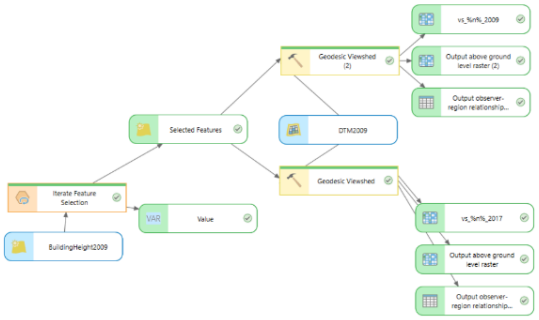
Identifying New Development

Using raster analysis in ArcGIS Pro, I calculated the difference between the 2009 and 2017 elevation datasets.

Areas with more than **40 feet of vertical increase** were classified as new or significantly expanded buildings.

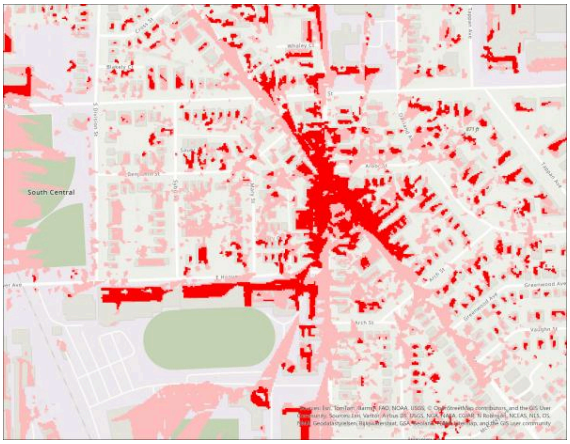
This produced a dataset highlighting major development across downtown Ann Arbor.

In order to calculate the viewshed for each points, I used the Model Builder tool.



I iterated through each point and calculated the viewshed at two different observer height: 2009 height, and 2017 height.

Results

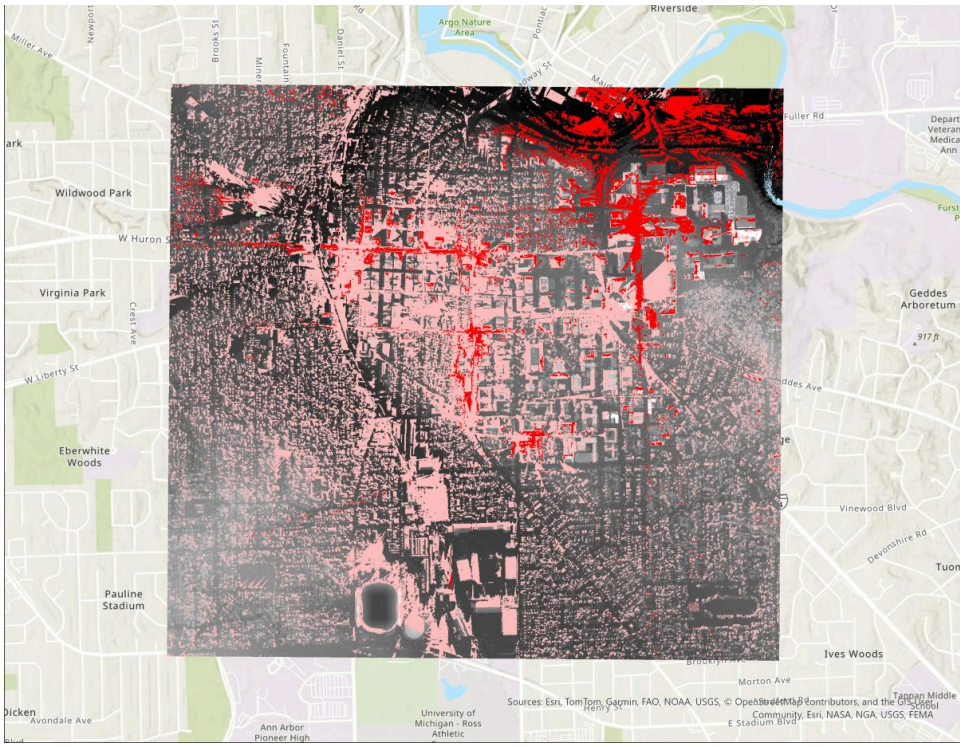


The results show a clear increase in building visibility across the city.

The pink area represents surfaces where you are now able to see one of the new buildings, and the red area marks where you were previously able to see the previous (and shorter) building.

Many buildings that were not visible in 2009 are now visible from large areas of downtown and surrounding neighborhoods.

Interpretation



By combining field observations with spatial modeling, this project connects **perceived change** with **measurable data**.

The areas where buildings became newly visible represent places where the skyline has fundamentally changed.

Limitations

This project has several limitations:

- Smartphone GPS accuracy limits precision of field points
- Only two LiDAR years were used
- Recent developments after 2017 are not captured
- Viewshed cannot fully encompass real-world elements

Future Work

Future improvements could include:

- Incorporating newer LiDAR datasets
- Using survey-grade GNSS for higher accuracy
- Expanding analysis to more buildings

- Integrating 3D city models

Conclusion

This project demonstrates that skyline change can be quantified using geospatial tools.

By combining GNSS field data, LiDAR elevation models, and viewshed analysis, I was able to measure how urban development has reshaped visibility across Ann Arbor.

This provided the answer to my question, by showing me the new areas in which you are now seeing building where there was once sky.