

# **Count, Area, and Volume of Buildings in Spokane U-District Census Blocks**

**Tom Truong**

**May 25th, 2021**

## **Goal of Analysis**

The use of LiDAR data from Spokane, WA was to be extracted to obtain the count, area, and volume of buildings in each census block. These variables would be used to calculate an estimation of population in each area. This small area estimation of population is optimally used in “sub-county area[s] such as census tracts, block groups, and blocks...” (Dong et al., 2010). The analysis will be performed in an area that houses buildings that support industry and higher education, with it being home to Spokane’s University District. This population analysis would be useful to estimate how much of the population can house the buildings, with each of the census blocks.

## **The Data**

The LiDAR data covers the Spokane U-District, which mainly contains Washington State University’s main campus. The property around the campus mostly contains buildings that are home to the smart city initiative called [Urbanova](#). I chose Spokane in particular because I wanted to look into an urban city, but something that was smaller in scale compared to the usual metropolitan areas in Western Washington. I then limited the area down to the University District for it’s high density of buildings compared to the rest of the city. The LiDAR data was obtained from the [Puget Sound Lidar Consortium](#) website, as a .laz file. The shapefile to represent the census blocks came from City of Spokane’s [Open GIS Data](#) portal for the year 2010.

In regards to the accuracy of the data, I consider it to be carefully planned out for collection from what the [project report](#) stated. To get the whole study area for Spokane a

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“specialized flight plan” was developed to get complete coverage for LiDAR. Also, they took into consideration to factors such as “satellite constellation availability and weather windows” and “any weather hazards or conditions” that can affect the flight operations (Norton, 2015).

## **Process of Analysis**

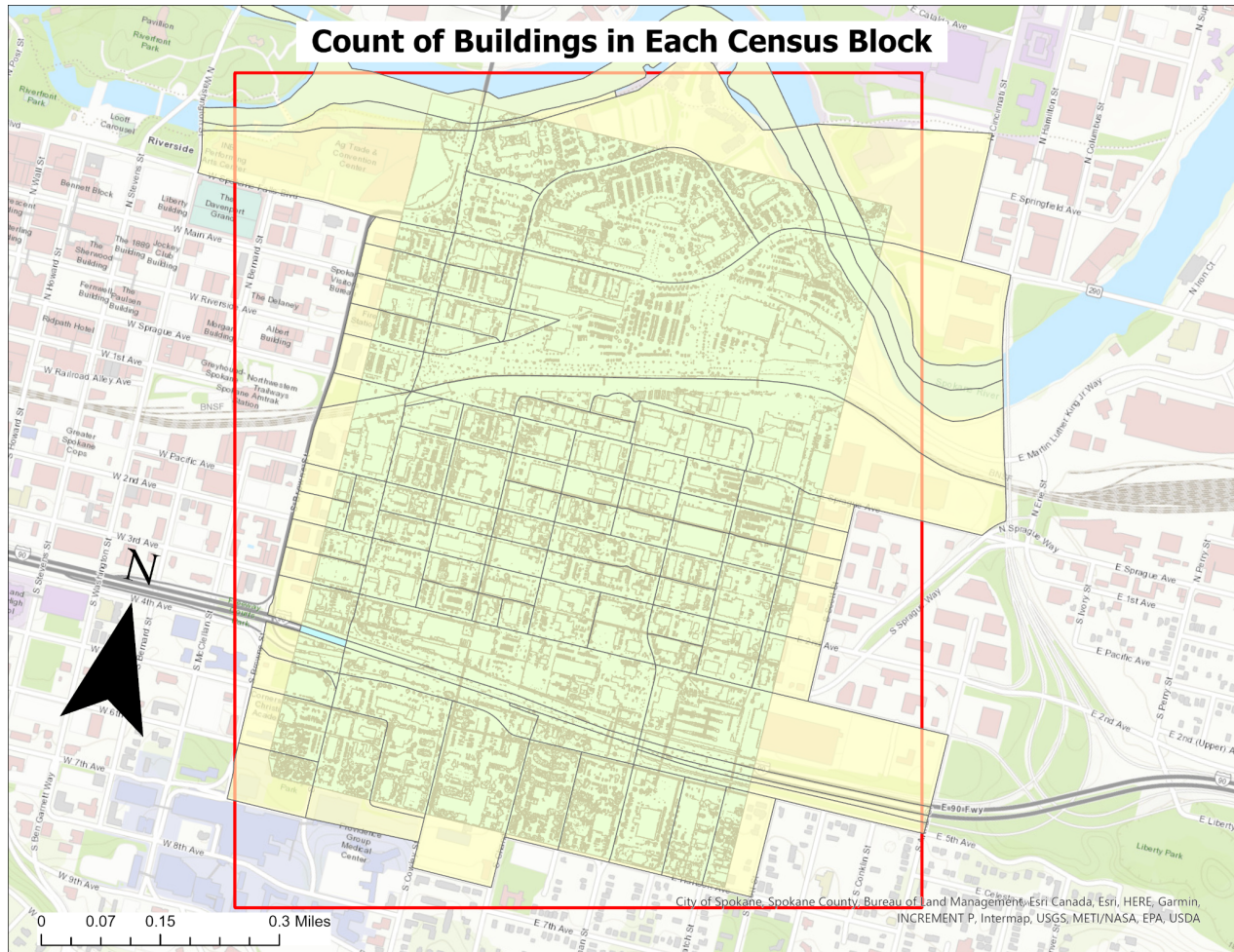
The steps to get the variables of count, area, and volume of buildings in each census block was directed by the book *LiDAR Remote Sensing and Applications* Pinliang Dong and Qi Chen. Based on the project of small-area population estimation for Denton, Texas; the step by step process was replicated to get similar data for Spokane, WA. The given Spokane .laz file was decompressed into a .las file that can be imported in ArcGIS Pro. A DTM layer was created using the ground points and a DSM layer was created including the non-ground points, and with the DHM layer created by the difference of the two prior layers. The buildings were able to be extracted by creating a binary mask of buildings being considered “1” and the non-building areas being “0”. The count of buildings per census block was calculated by a spatial join of buildings contained in each block, while area and volume was calculated by zonal statistical analysis.

This process resulted in a wide range of estimations for the count, area, and volumes of the buildings in each census block. 105 census blocks were contained in this Spokane area and showcased in this analysis. The building outlines ended up not being shaped out properly, leaving some noise on the map that counted towards the building count. The building count ranged from 16k+ (which seems unreasonable) to 23 buildings. The building area count ranged from 418,367 to 1,063 m<sup>2</sup>. The building volume count ranged from 10,881,724 to 7,810 m<sup>3</sup>.

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	OBJECTID *	FID	COUNT	AREA	SUM
1	1	25	1840689	1840689	418367
2	2	564	96469	96469	29783
3	3	625	42841	42841	19250
4	4	849	70587	70587	26523
5	5	850	70055	70055	25526
6	6	973	221476	221476	111205
7	7	984	39721	39721	19566
8	8	1329	41727	41727	12070
9	9	1466	167829	167829	68848
10	10	1467	70197	70197	25721
11	11	1599	28012	28012	15244

0 of 105 selected

	OBJECTID *	FID	COUNT	AREA	SUM
1	1	25	1840689	1840689	9077365.966553
2	2	564	96469	96469	484560.68811
3	3	625	42841	42841	391357.726318
4	4	849	70587	70587	301202.389771
5	5	850	70055	70055	417885.840576
6	6	973	221476	221476	2517467.166138
7	7	984	39721	39721	293601.264893
8	8	1329	41727	41727	212535.497803
9	9	1466	167829	167829	2189239.701172
10	10	1467	70197	70197	451737.186646
11	11	1599	28012	28012	234720.376099

0 of 105 selected

*Area of Buildings (SUM column)*

*Volumes of Buildings (SUM column)*