

# UTAH VALLEY UNIVERSITY 3D VIRTUAL CAMPUS

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**Utah Valley University**



# Background

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- ▶ Constructing UVU's 3D virtual model
- ▶ Future Research Directions
- ▶ Demand for 3D geospatial data
- ▶ Initiated in the Geomatics program

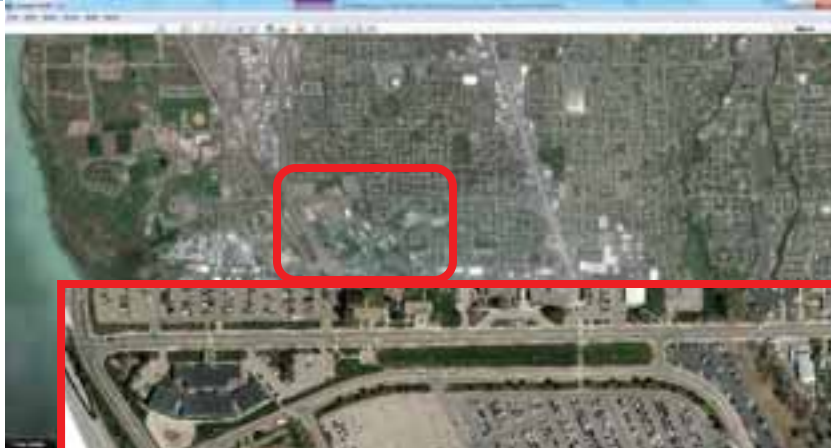
# Goal

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Demonstrate : ArcGIS with the integration of AutoCAD / Revit can be used to create a three dimensional model of Utah Valley University (UVU)



# Location



# Aerial imagery

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- Spatial resolution – 10cm
- Spectral resolution – 4 bands (B, G, R and IR)
- Large format Ultra-CamX camera
- After winter - before spring (April 24<sup>th</sup>, 2013)
  - Leaf off and snow off conditions



# LiDAR Data

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- ▶ 6.5 pts/sq.m.
- ▶ Provided in LAS 1.2
- ▶ Raw, bare earth and first return data

# CAD DRAWINGS(DXF ) of UVU Campus

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# CAD of UVU Campus

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- ▶ Maintained by the University's Facilities
- ▶ Absence of spatial content
- ▶ Absence of trees, light posts, etc
- ▶ Too much information
- ▶ Reliable shapes of building and other features





# Funding and Grants

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- **Grants for Engaged Learning (GEL, UVU) and Summer Research Grant (UVU)**  
Funded in 2012-13
  - Acquire very high resolution aerial imagery and LiDAR data
  - Geomatics and GISStudent involvement



# Integration of multi sensors

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- ▶ Accuracy enhancement
- ▶ Limitations related to occlusions, shadows and disadvantageous viewing angles
- ▶ LiDAR provides precise height of features, and bare earth model

# Data for 3D models

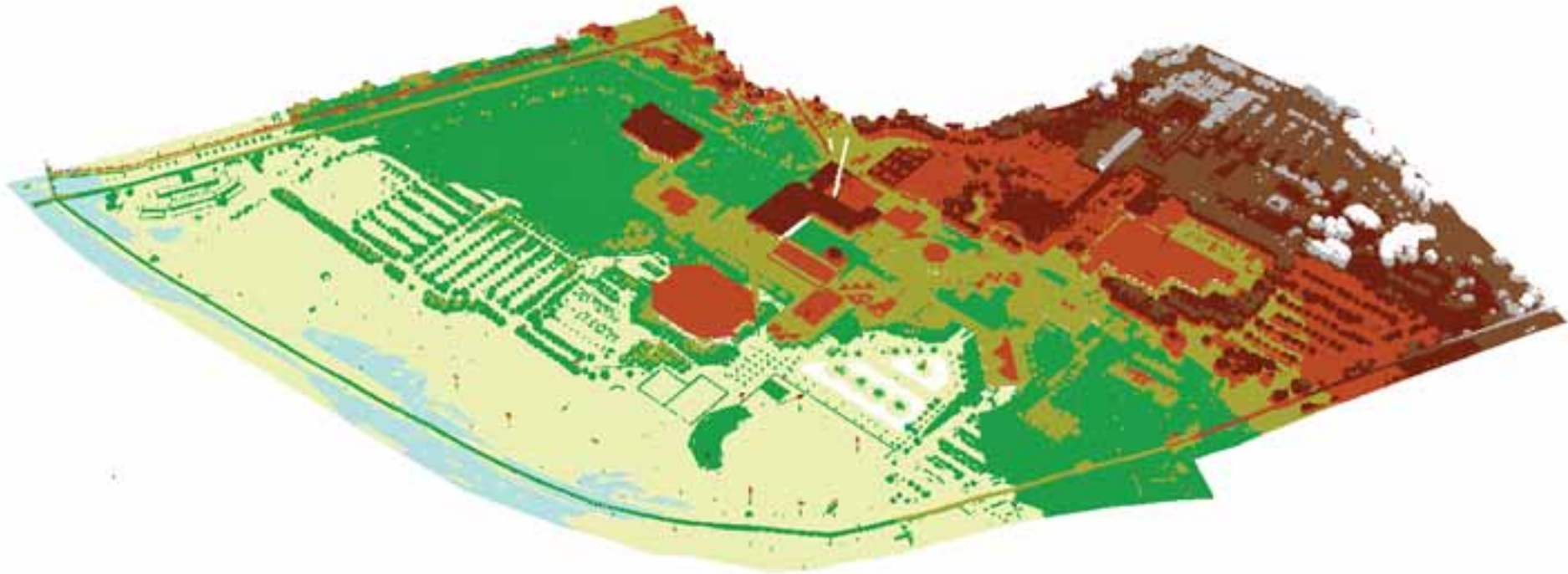
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- ▶ To reconstruct
  - ▶ Terrain surface
  - ▶ Building geometry

# LiDAR (LAS Dataset)

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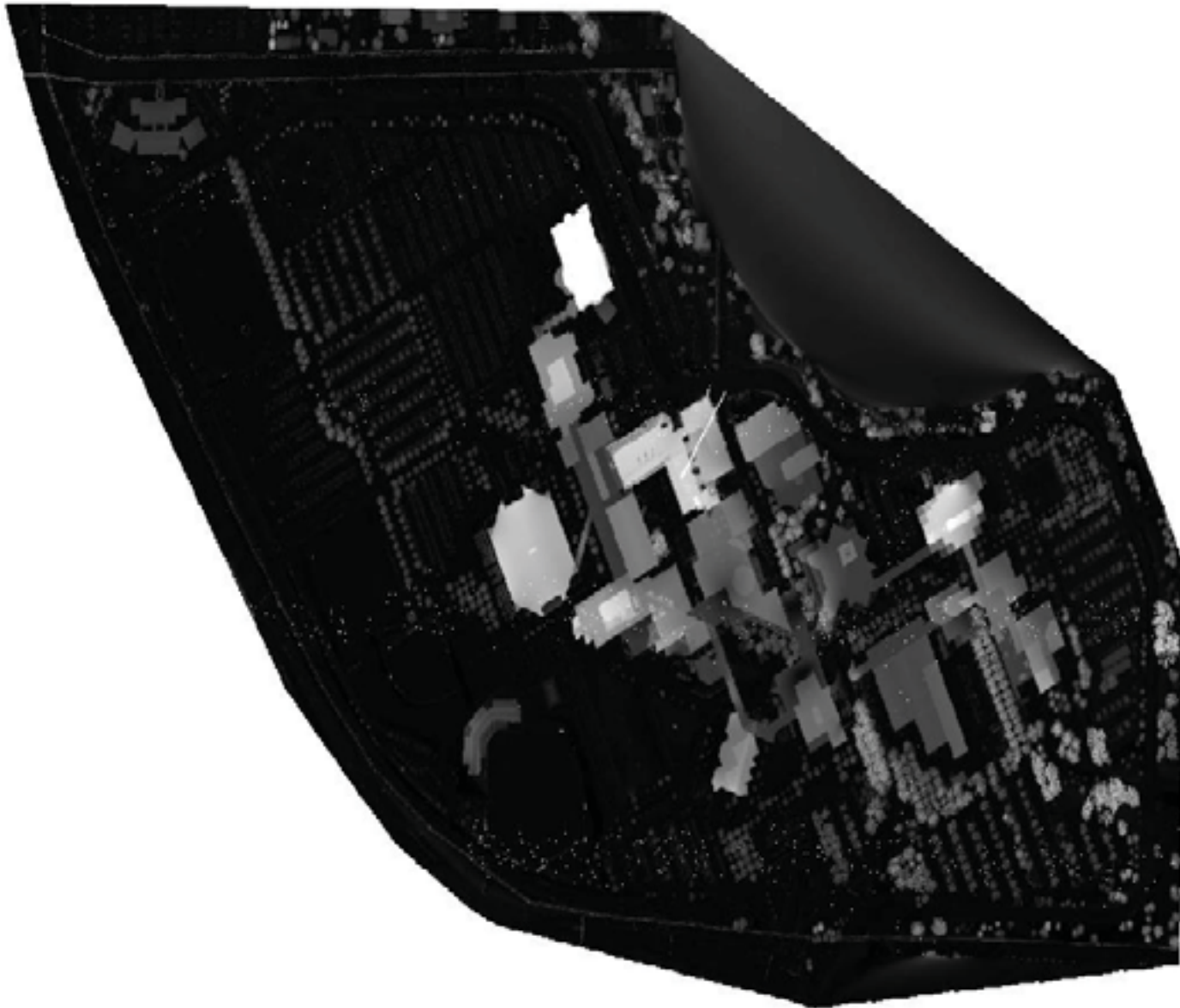
## Color Coded with elevation



# Derived Surfaces from LiDAR

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- ▶ Multi points to bare earth model
- ▶ Hillshade
- ▶ Contours



## Adding Elevations

Result gave us the heights of objects on campus.

# Datasets - AERIAL IMAGERY

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- ▶ Building footprints with surface info
- ▶ Sports /Recreation centers
- ▶ Parking lots
- ▶ Trees
- ▶ Road centerlines

# Building footprints with Heights



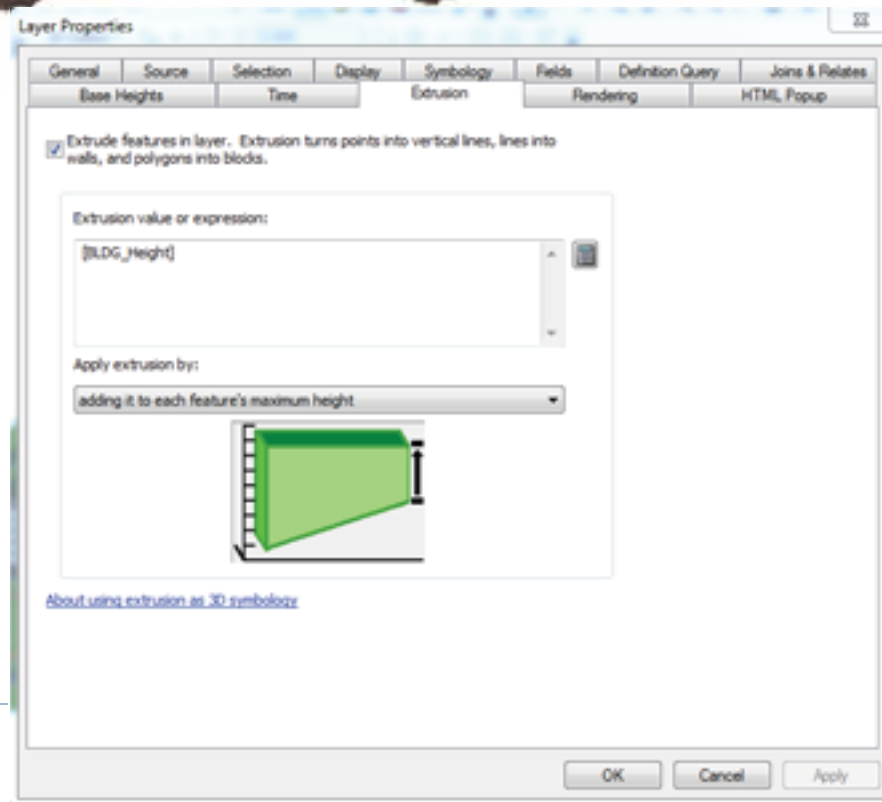
- Footprints - Aerial Image
- Footprint surface information - Building heights from LiDAR



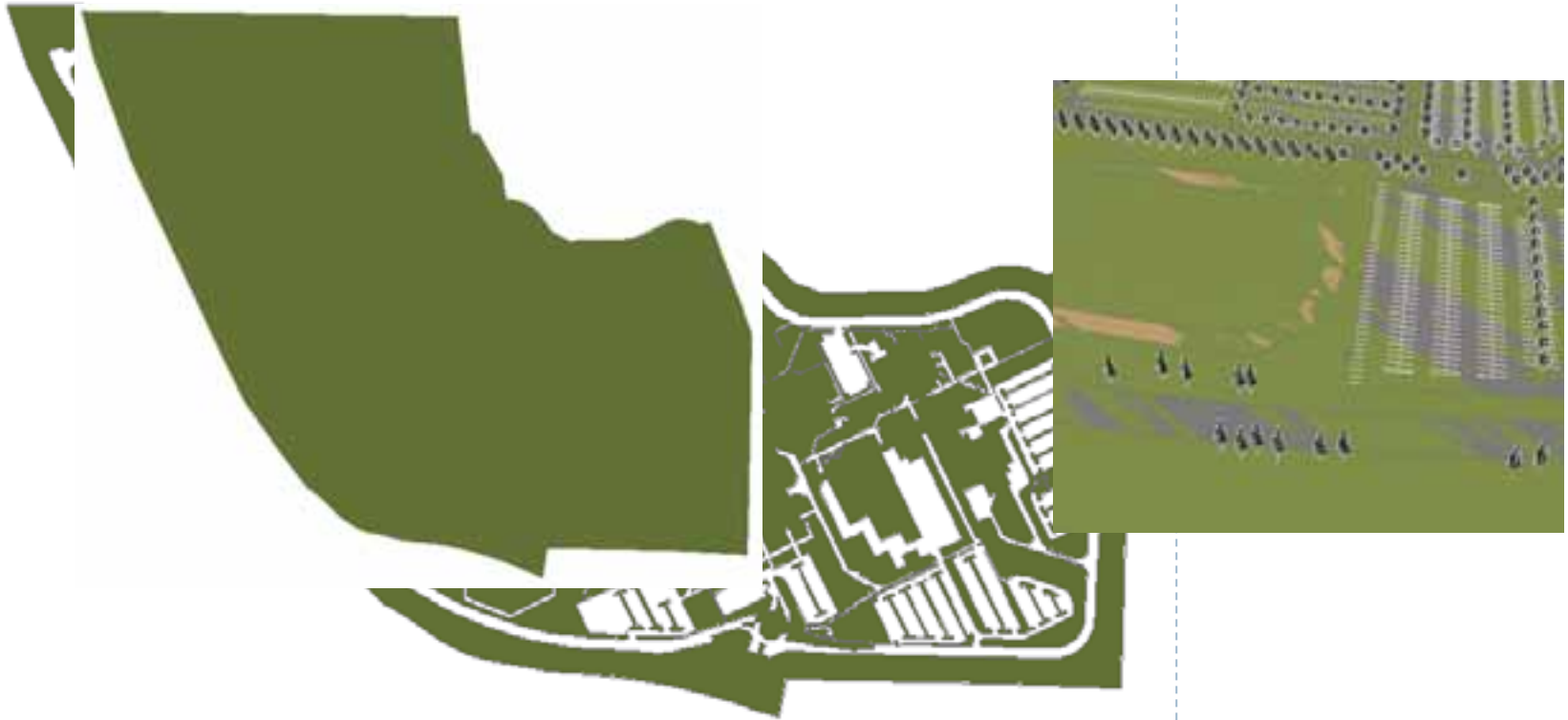
FID	Shape	M	Z_Min	Z_Max	Z_Max	Shape	BLOCKNAME	SHPRT_BLDG	BuildingHgt
1	Polygon	4	1078.75735	1262.27071	1385.73273	2271.89994	WOLFRINE SERVICE CENTER	178	3.14288
2	Polygon	4	1078.83128	1262.21469	1382.98878	1472.84408	WOLFRINE SERVICE CENTER 2	445	4.12741
3	Polygon	4	1084.47246	1478.28221	1599.24718	3088.67547	UNION CENTER	212	25.4342
4	Polygon	4	1084.35649	1477.84842	1442.92546	2878.74874	LIBRARY	121	26.2403
5	Polygon	4	1085.70627	1485.14034	1386.92792	2471.88003	LIBRARY 2	124	16.8882
6	Polygon	4	1267.40332	1398.14674	1796.26449	4982.17941	PHYSICAL EDUCATION	146	11.3871
7	Polygon	4	1382.42509	1398.34021	1382.34423	4278.87081	SCIENCE BUILDING	142	14.6481
8	Polygon	4	1382.84117	1398.76840	1386.32744	4008.23519	PURE SCIENCE	148	16.3881
9	Polygon	4	1387.84082	1391.82728	1387.82781	3482.17912	ENVIRONMENTAL TECHNOLOGY	214	3.98378



# Functional Surface Heights



# Grass

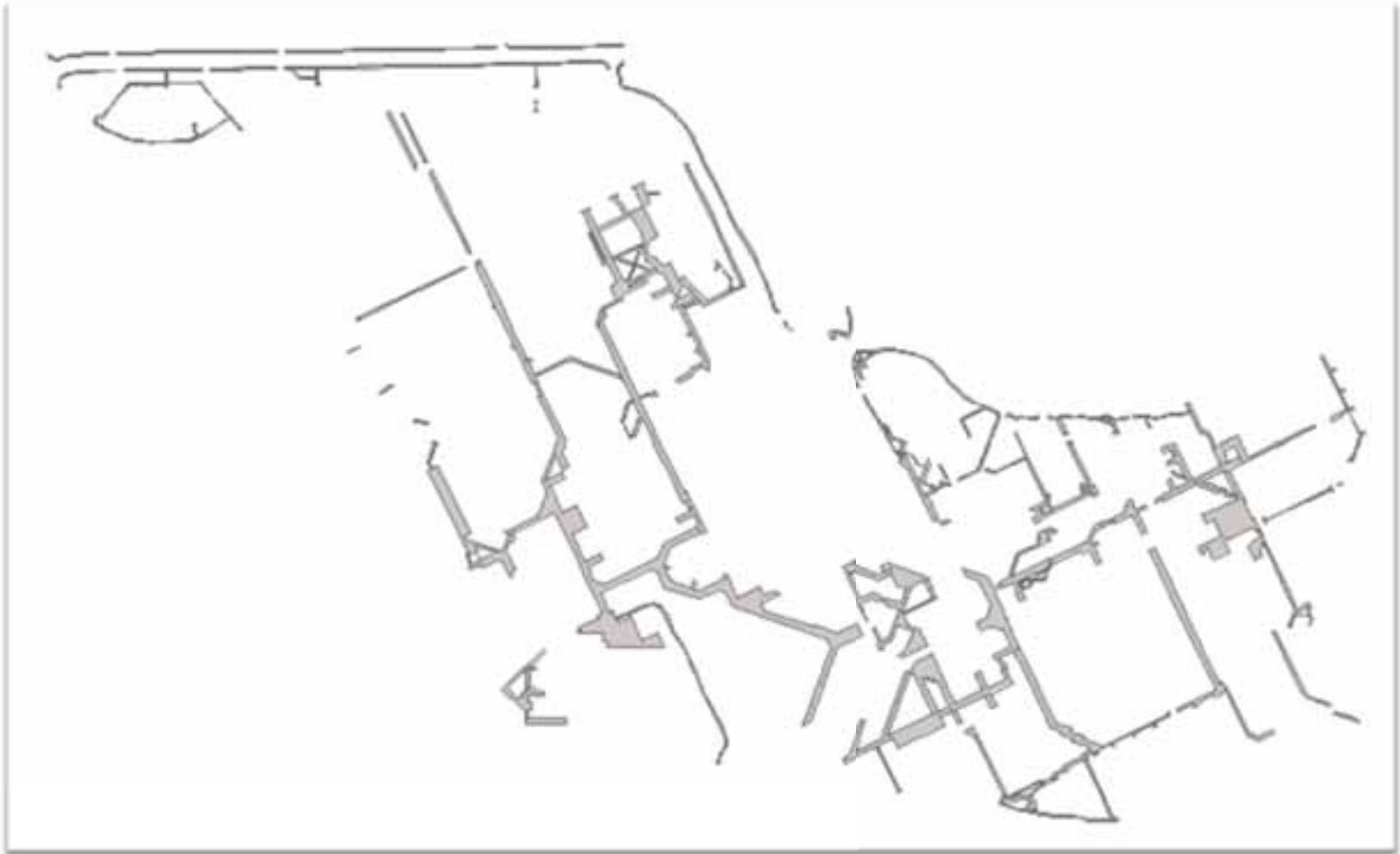


# Trees and Light Posts



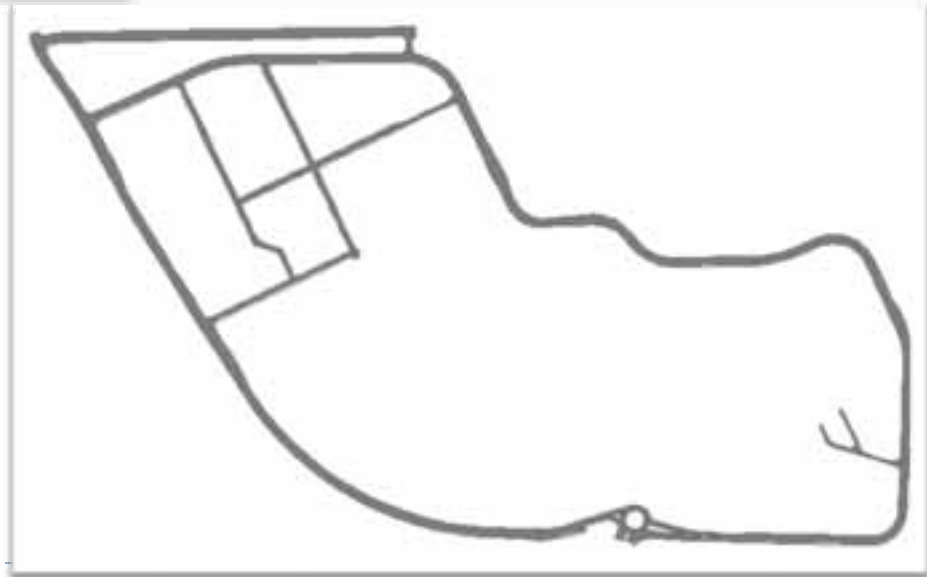
# Sidewalks

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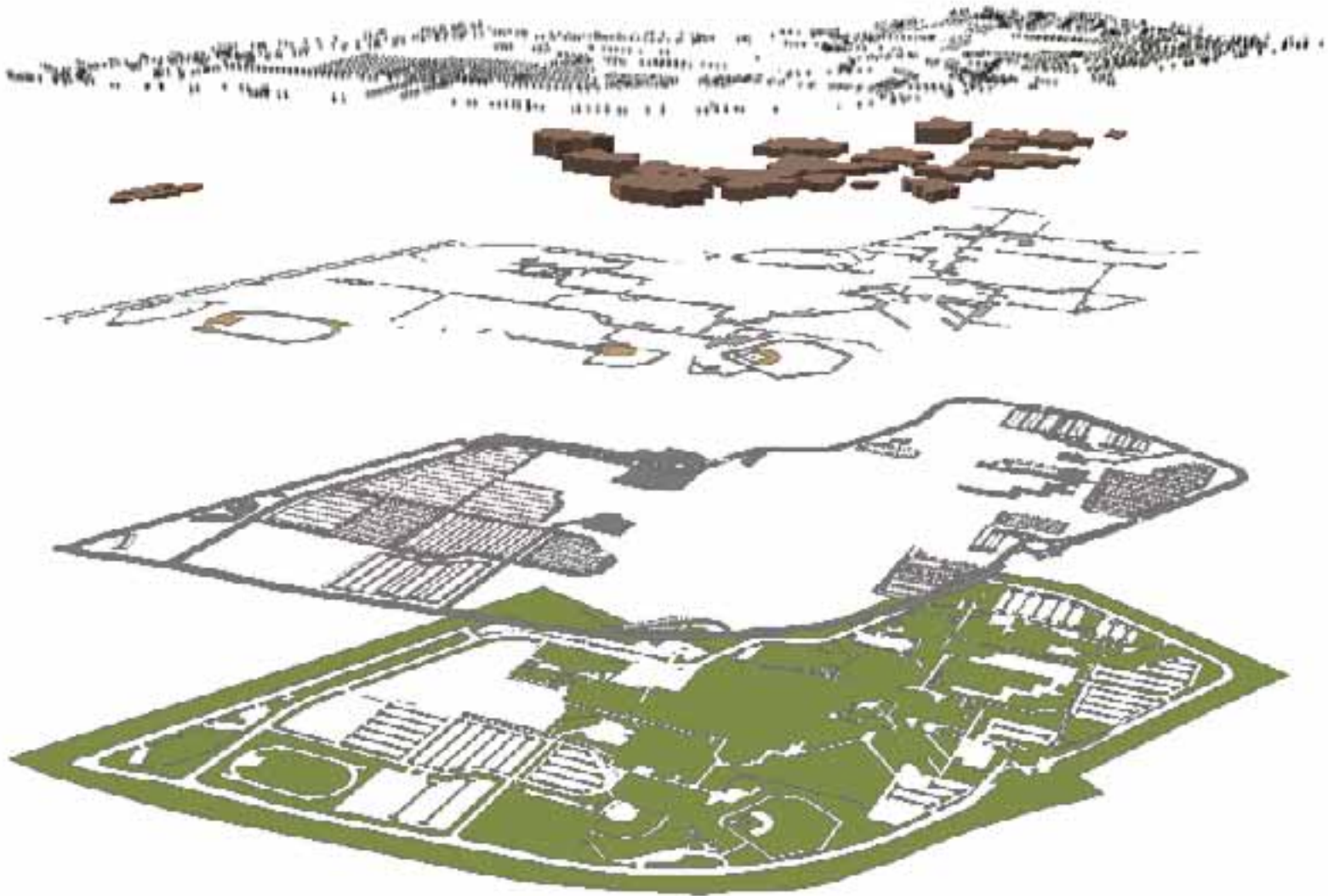
# Roads and Parking Lots

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# Combined Layers

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# UVU – 2D Map

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# 3D Modeling in GIS

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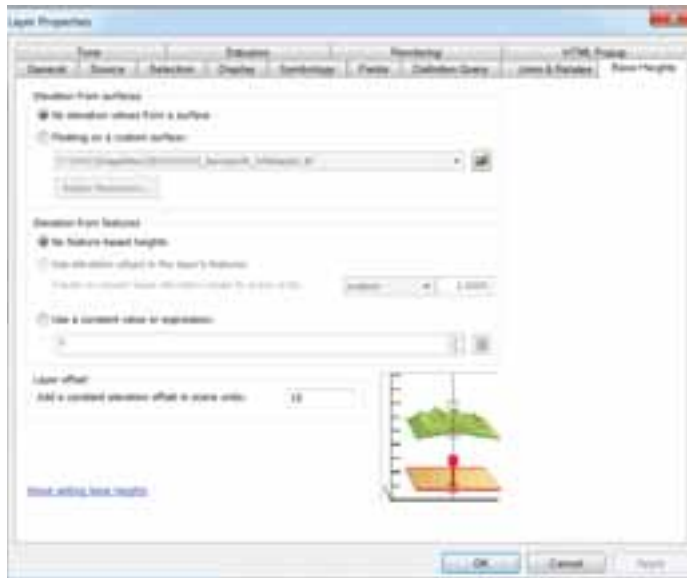
## Animation in ArcScene



- Layer properties in Arcscene
- Providing Base Heights for Buildings
- Rendering Objects in 3D/Picture Fill



# Layer properties in Arcscene



# 3D UVU Model

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# 3D UVU Model

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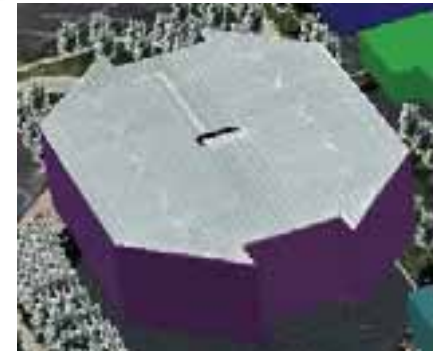
# 3D UVU Model

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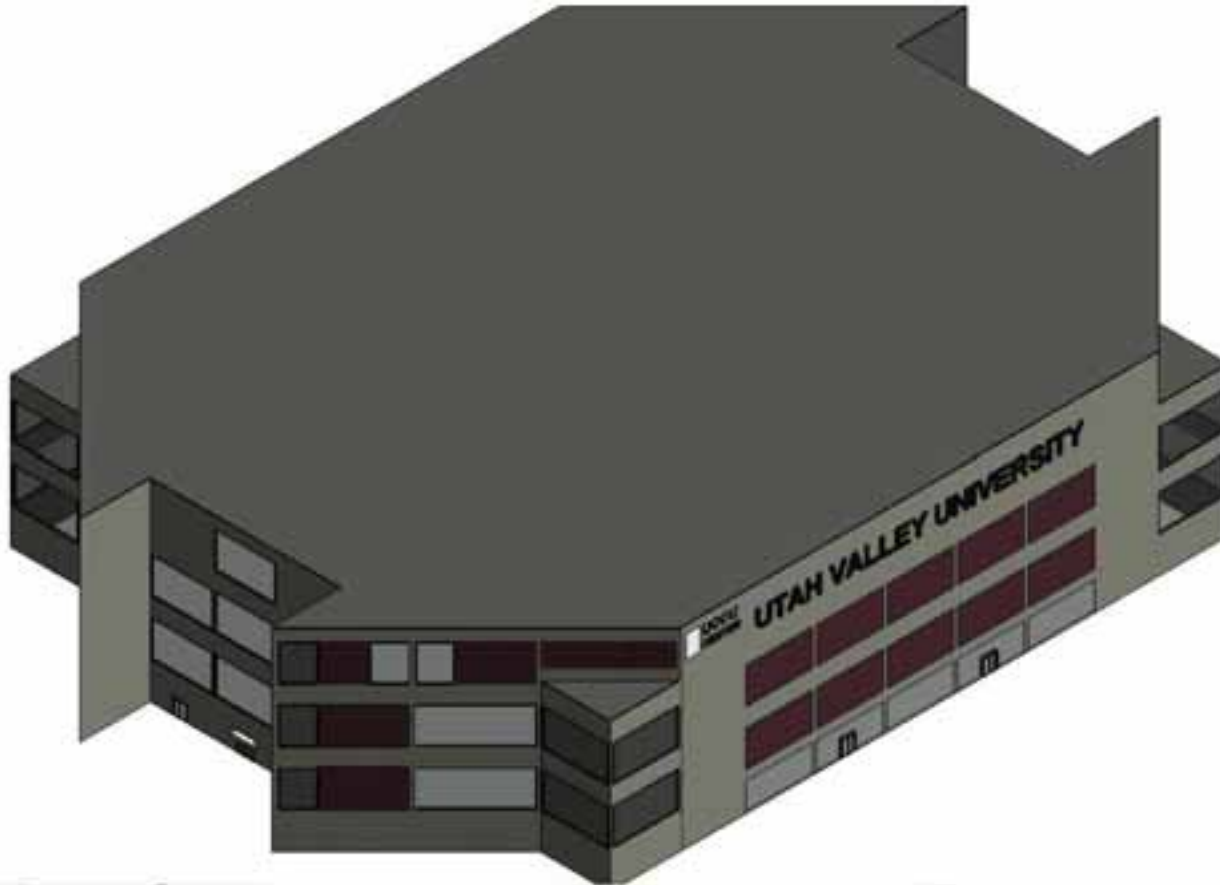
# Building Objects - Revit

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# Revit Model

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# 3D Trees – Rendering Objects



-  Crabapple
-  Locust
-  Maple
-  Pine

# Pending Results

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- ▶ At the time of publication, certain results were pending. They will be available during the conference presentation



# Conclusions

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- ▶ Impossible to capture every detail
- ▶ ArcScene - Capabilities to display smooth surfaces
  - ▶ includes true three-dimensional symbols and textures
  - ▶ extrude and offset two-dimensional features into three dimensions
  - ▶ functionality necessary for anyone to begin the fun of creating a three-dimensional virtual world
- ▶ Interesting visualizations that could include creating photorealistic buildings and incorporating them into the ArcScene model
  - ▶ CAD + Geomatics students

# ACKNOWLEDGEMENTS

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