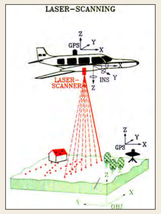
PLATE ONE

3D Visualization of Buildings and View Planes for the Halifax Citadel

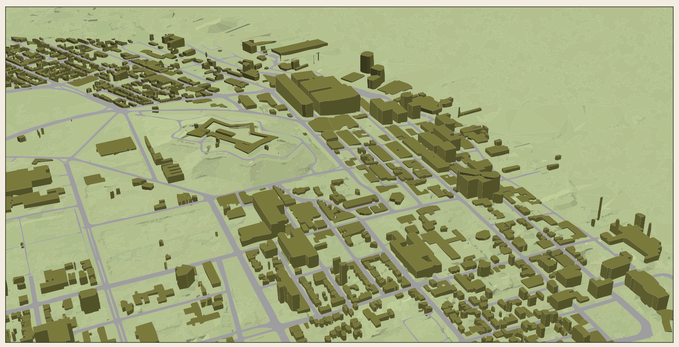
Introduction to LiDAR

LiDAR [Light Detection and Ranging] is a technology employed to gather terrain data for mapping and remote sensing purposes. This system utilizes a laser light that strikes the earth's surface and measures the time it takes for the pulse to return. Modern systems have the ability to record up to 5 returns per pulse. LiDAR allows for the collection of important data in conditions that are otherwise unsuitable for other forms such as aerial photographs. This technology is able to reflect details in full leaf situations and provide points for varied surfaces. Complexity can vary greatly from area to area, but generally speaking, the data sets are massive, sometimes 200,000 to 350,000 points per square mile.
One very beneficial element of LiDAR is that the collected information is, from inception, geo-referenced so it requires no manipulation prior to interfacing with GIS applications.

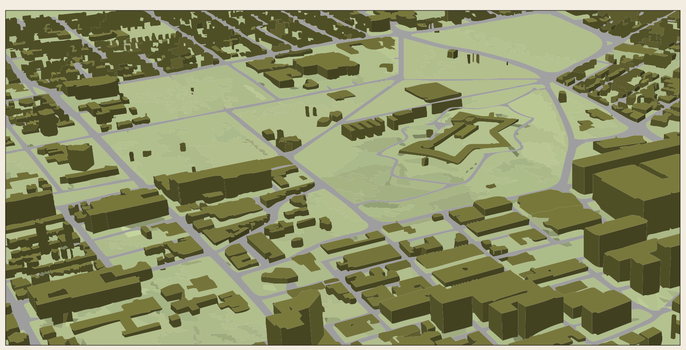


An example of LiDAR points known as 'hits'.

LiDAR technology has also found markets in science as well as industry where it is used to effectively measure things such as:
- Temperatures, winds and waves;
- Clouds, aerosols, and water vapour
- Ozone depletions and polar stratospheric clouds
- High altitude trace metal measurements
- Pollution monitoring
- Sodium layer guide stars for adaptive optics
- Planetary surface relief mapping
- Erosion monitoring
- Harbour profiling for marine saftey
- Assess forest growth and health
- Safe aircraft maneuvering near airport terminals.



3D replication of downtown Halifax facing the waterfront.



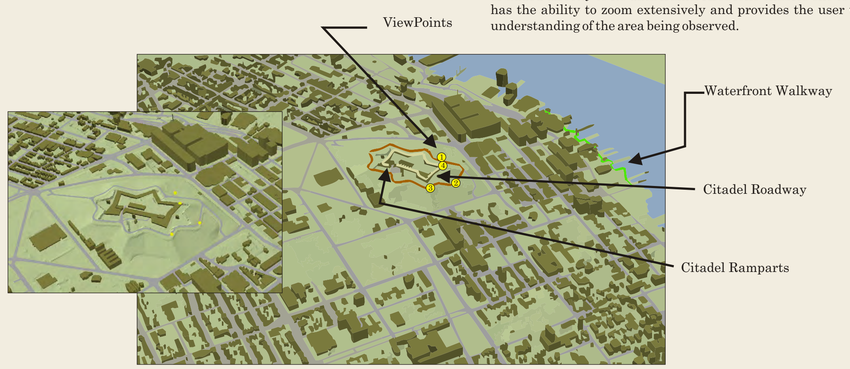
3D replication of downtown Halifax facing inward from the waterfront.

This piece was created as a portion of
GEOM 2022 - Applied GIS
It is a student exercise and as such
is unedited and unverified.

Produced by Lucy Hughes April 22nd, 2009

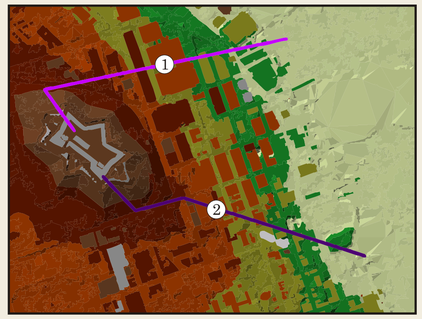
LiDAR information obtained from:
- http://www.sbgmaps.com/lidar.htm
- 2009 GEOM 2022 3D Part 4 Visualizing Lidar.pdf

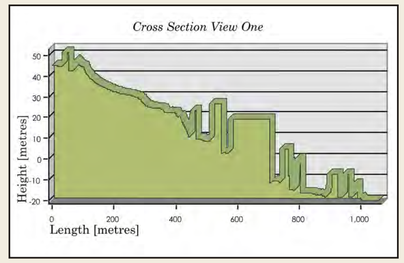
Visibility Profile of Downtown Halifax

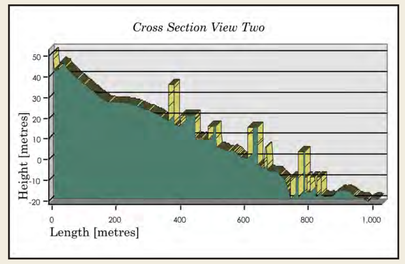


ArcScene was used for all the 3Dimensional representations in this project. Layers were manipulated in **ArcMap** then either copied and pasted into an ArcScene session or added directly to its data frame. ArcScene enables one to view objects at all angles, has the ability to zoom extensively and provides the user with a greater depth and understanding of the area being observed.

Cross Section Views from the Citadel

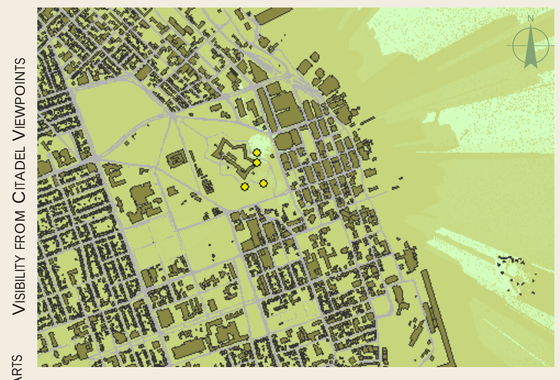


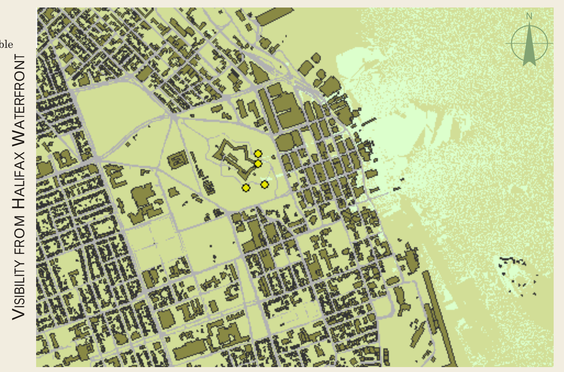




These Cross Sections were created in **ArcMap 9.3**. View lines were drawn into the data frame to start. These lines were then converted to features by way of Graphics to Features [a new element of 9.3]. *ArcToolbox* was run - Interpolate Shape. The resulting line was then brought back into the map. From here an **Edit** session began and the line selected. Double clicking the line and then right clicking and selecting **Properties** provided attributes of that line. In the *3D Analyst toolbar* resides a handy graph button. When this is clicked a cross section graph appears. This graph is customizable and editable. These were exported out of ArcMap where they were finalized in CorelDRAW X4.

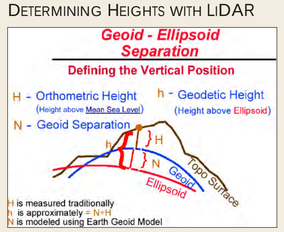
Visual Analysis Plans





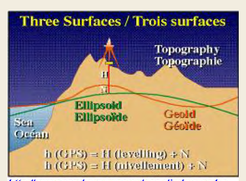
These Visibility plans articulate views from the Citadel Ramparts, Citadel Roadway the Waterfront Walkway and from the four observation points. They were created in ArcMap 9.3. Buildings and Roads were added to give more of a frame of reference.

Determining Heights with LiDAR



There are 3 reference surfaces use for Z-values:

1. *Ellipsoid* – Mathematical geometric model of the earth.
2. *GEOID* – Model based from the gravitational model – heights as if there were no land – sea level.
3. *Topographic* – a model based on 0-height being applied to MSL (Mean Sea Level) usually defined by the intersection of the GEOID and the ELLIPSOID.



http://www.geod.nrcan.gc.ca/apps/index_e.php

Downtown Halifax Aerial Photograph Mosaic

This Mosaic was created in ArcMap 9.3 out of 5 aerial photos. They were geo-referenced and rectified before being blended together.

This compiled LiDAR plate was created in ArcMap 9.3 , ArcScene, CorelDRAW X4.

AGRG Applied GeoResearch Group — Centre of Geographic Sciences, Middleton | Nova Scotia | Canada
GeoConnections — Canadian Hydrographic Service — Fisheries and Oceans Canada — Science
Nova Scotia Nouvelle-Écosse — Province of Nova Scotia
Centre of Geographic Sciences
GIS Technician Certificate Program
Cartography, Digital Mapping Program