

# Photogrammetry at the City of Ottawa

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The City of Ottawa, the nation's capital and fourth largest city, has always maintained a corporate culture of progressive, business-driven, return on investment strategy. Senior management supports the work of its professional staff including that of the land surveyor. Originally with the Regional Municipality of Ottawa-Carleton (RMO), the Surveys and Mapping Group has always utilized photogrammetry as a tool to efficiently satisfy mapping requirements.

For thirty years, the regional roads have been photogrammetrically mapped from highly detailed, coloured, 1:2400 scale aerial photographs. Using accurate ground control surveyed by in-house survey crews, measurements of well-defined features have been expected to yield 7-9cm accuracies. This accuracy far outpaced the 1:500 scale manuscripts provided to the Engineers. With the exception of the ground control, this work was contracted to aerial photographers and local mapping firms. Eventually, with the advent of the CAD file, the accuracies from the aerial

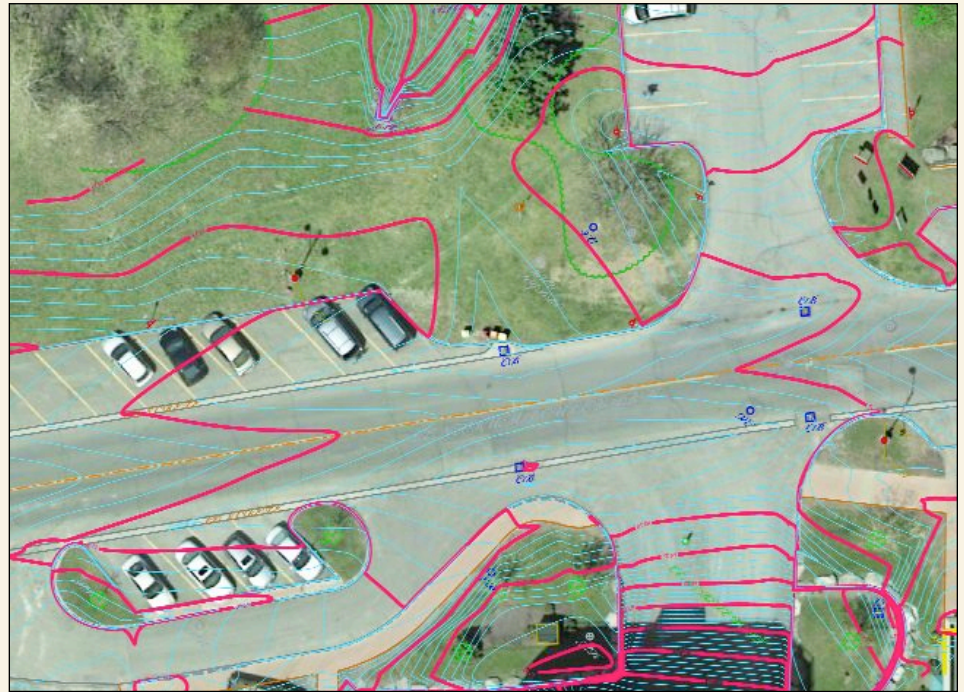


Illustration 1

mapping were less able to satisfy the requirements of the Engineers. Total station surveys replaced photogrammetric surveys and only the largest projects were mapped by aerial means in an effort to reduce costs.

In 2001, the RMO and area municipalities amalgamated to form the new City of Ottawa. The work performed by Surveys and Mapping expanded to include different products including local improvement surveys and property site plans. These infrastructure renewal programs typically required 2-3cm accuracy on all features and had to include door and windowsill measurements not available from photogrammetric surveys.

Along with municipal changes, the photogrammetric industry over the last 10 years has undergone dramatic changes. Where once expensive optical-mechanical devices were required to prepare stereo-compiled information, virtually all mapping is now prepared using desktop computer systems. Additionally, and most importantly, stereo-compilation has seen a labour shift from local to offshore markets. It is no secret that running shoes and iPods are manufactured offshore, and now, so too are maps. Unit prices for compilation

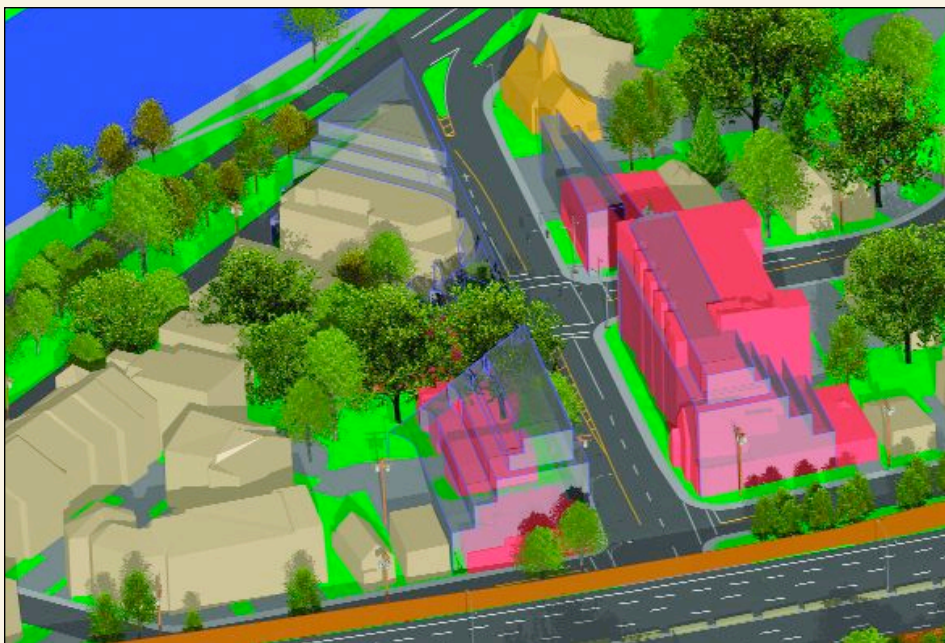


Illustration 2



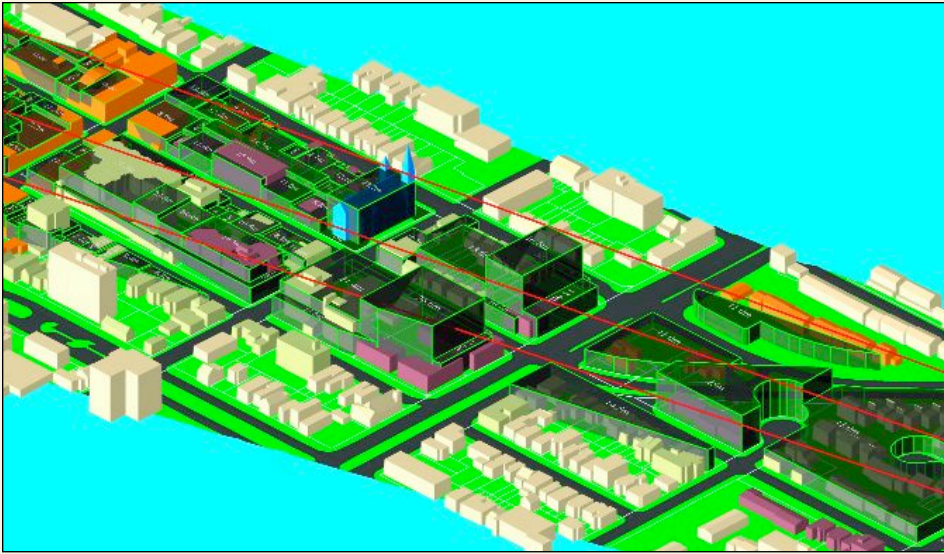


Illustration 3

have in some instances been reduced fivefold.

Technologically, digital cameras have all but replaced film. Their images are finer in detail, possess a greater dynamic range and are geometrically more accurate. Although having a smaller frame size, the resultant images fit easily into the digital workflow. In fact, amazingly, there is seemingly a role reversal regarding photogrammetric work. Aerial triangulation and numerical adjustment used to be the 'hard' work. Now it is virtually automated and error free. The compilation of vector mapping or ortho-photographs tends to be the labour intensive work requiring offshore assistance.

This price competitiveness along with technological advances has recently brought the popularity of photogrammetry back in vogue at the City of Ottawa. Three years ago, the City purchased two Z/I Imaging photogrammetric workstations. Each hardware platform is capable of displaying stereoscopic imagery and has the capability of performing all aspects of the photogrammetric workflow. Aerial imagery from large format digital cameras acquired from flight contractors has been used to produce ortho-photos, compile vector mapping and provide stereo-compilation services to engineering, planning and architectural units within the City. In fact, where others have used the greater geometric qualities of the new digital cameras to fly at higher altitudes,

Surveys and Mapping has acquired imagery with resolutions as small as a 3cm ground sample distance. This in some cases has the potential to replace total station surveying with 3-4cm accuracy vector mapping. For large project areas or where traffic and adverse terrain proves technically challenging, this photogrammetric mapping may become economically viable once again.

For small sites, it makes financial sense to perform all aspects of the work (besides the photography) in-house. Whether full vector compilation or only ortho-photo is required, small projects can be completed quickly and at minimal cost over that of the original workstation investment. Illustration 1 shows a small



Illustration 4

site survey that was prepared to study the local overland drainage flow of water into a basement garage.

Large projects, on the other hand, benefit from having the 'easy' work such as the ground surveying and aerial triangulation and numeric adjustment completed in-house and the labour intensive compilation tendered to a mapping firm for completion.

Now with in-house 3D capabilities, other uses of photogrammetry are being explored. The City's planning groups have requested full 3D visualization projects. Community design plans are now modelled entirely in 3D and zoning scenarios are interactively modelled using the stereo workstations. When planners are required to discuss dry numerical and esoteric spatial concepts with other departments or the general public, 3D visualizations can be used to simplify and elucidate. Photo-realistic renderings and solar studies are two such applications. Illustration 2 shows a study of the existing buildings and proposed zoning envelopes on Main Street and includes a study of solar shadows.

Illustration 3 is a view shed study. For the Tommy Douglas Memorial project, protective three dimensional zoning controls for an unobstructed view in perpetuity of Parliament Hill was required. A full 3D model of the terrain, buildings and existing zoning envelopes between the two sites were studied to

determine what new zoning requirements were needed.


Every three years, the City acquires City-wide photography. This is available on the City of Ottawa web site at [www.Ottawa.ca](http://www.Ottawa.ca) using the eMap application. The web site shows both vector and raster information and includes property data from Teranet. The imagery for public consumption is displayed at no better than 20cm resolution. The City has, however, acquired urban-wide stereo-imagery at 6cm resolution. This project was initiated to geo-locate all catch basins and manhole covers within 10cm of their true locations. The imagery can easily provide vector mapping at 1:500 scale and its ortho-photography can be displayed at scales up to 1:250.

As image resolutions become more refined, more personal information is visible. As long as single individuals cannot be identified within the image, it has been determined that the City can acquire and utilize this imagery for its own internal uses. The City, however, would be

liable and susceptible to recourse if information contained in the imagery was used in damaging ways by any third party. To protect against this liability, the majority of staff and all public access is limited to 18cm resolution. This resolution is close to the seemingly acceptable 20cm range that has long been displayed on the City's web site.

With better than 6cm resolution, vector mapping has been performed at the City using 3cm resolution imagery. Illustration 4 shows a sample of this type of imagery. The collection and use of this information is presently undergoing close scrutiny. The issue seems to be a matter of scale and there is a varying degree of acceptability. At one end of the scale there is public acceptance of satellite imagery taken from outer space. However, on the other hand, having an airplane acquire imagery from only 350 metres overhead is another issue. Is public notification prior to and after flights required in this case? Does the general public have the right to

refuse the City's request to acquire this imagery? These are issues not yet resolved to any degree of certainty.

Since the advent of computer based digital design and construction, there has been pressure on the use of electronic mapping to provide cost-effective and accurate base design data. Photogrammetry is capable of meeting specific accuracy levels in a cost-effective and safe way. The City of Ottawa is applying this photogrammetric technology to take full advantage of it within the municipal government environment and continues to investigate new uses to reduce expenses and make better use of public funds. 

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