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INTRODUCTION

The Engineering Department of the City of Barrie has modified the subdivision engineering conditions, and major site plan agreements to make it mandatory for all new development to be processed in a digital format, using UTM (Zone 17) NAD83 (Original) datum. Upon registration of a subdivision in the Land registry office and after completion of construction, digital information must be provided to the City so that the subdivision fabric and “as-built” servicing drawings can be directly inputted into the City’s digital mapping program.

The City of Barrie has established a horizontal survey control network consisting of approximately 95 monuments in inter-visible pairs. The control data has been produced using NAD83 (Original) datum and is published in 6 degree UTM coordinates, which has been approved by M.N.R. for input into the COSINE database.

The network has been established for three major reasons: to provide the framework for accurate digital property mapping; to provide updated topographic data to be implemented into the 1:2000 Ontario Base Mapping (O.B.M.) revision program; and as the referencing network of all survey and land development projects undertaken within the City.

As part of the City’s digital mapping program, it is the intention of the City of Barrie to require that all surveys and land development activities (including major site plans with buildings 25 units or larger and/or 25,000 sq. ft. or larger), be tied to this network and submitted in digital format.

Specifications for the digital CAD data, and control information can be obtained from the Design and Construction Division of the Engineering Department, 70 Collier Street, Barrie, Ontario, L4M 4T5; attention: John Struik at telephone number 705-739-4220 extension 4513.

DEFINITIONS

Control Survey Station - a point in a horizontal control survey network referenced by monument, for which the geodetic position has been determined to at least third order accuracy in accordance with "Ontario Specifications for Horizontal Control Surveys" (OS 79).

Horizontal Control Survey - control survey established by precise survey methods, which produces coordinated position values for monument points on the earth's surface, and provides a reference framework (Ontario Geographical Referencing Grid - UTM 6 degrees). For the City of Barrie (Zone 17), located between longitude 78 degrees west and longitude 84 degrees west.

Integrated Survey - a cadastral survey in which the survey points have been coordinated relative to the 6 degree UTM (Zone 17) Horizontal Control Network, in compliance with classification standards outlined in "Ontario Guidelines for Horizontal Control Survey" (OG 79).

Unique Identifier - (monument numbers) - a unique and coded label will be given to each integrated 2nd order control survey monument. This identifier is established by Engineering Department of the City of Barrie and confirmed after the values have been submitted for approval by M.N.R.

Classification of Integrated Surveys - a cadastral survey including the monuments contained therein will be classified as an integrated survey and integrated monuments respectively, without regard to the method of survey, according to the length of the semi-major axis of the 95% confidence region of its coordinates-ordinates, relative to other monuments in the survey, to adjacent horizontal control stations, and to other integrated monuments as set in "Ontario Specifications for Horizontal Control Surveys" (OS 79).

"The length of the semi-major axis of the 95% confidence region, after adjustment, must be no greater than the value of "r", where "r=20d" and "r" is expressed in centimetres and "d" is the distance between neighbouring points expressed in kilometres. Notwithstanding the length of the semi-major axis, a monument shall be classified as integrated, the semi-major axis of the 95% confidence regions must, after adjustment, be no greater than 20d or 2 centimetres, whichever is greater in relationship to the neighbouring horizontal control and integrated monuments."

Use of SI (Metric) Units - published information for integrated surveys shall be in SI (metric) units only.

Cadastral Survey Integration - a cadastral survey is integrated when it is connected to nearby existing horizontal control stations (preferably one on each side of the survey), and all adjacent integrated monuments.

Instrumentation - the instrumentation and procedures used for angular and distance measuring observations shall be in accordance with recommended procedures for second, third, and fourth order surveys, as outlined in "Ontario Specifications for Horizontal Control Surveys" (OS 79).

Computer Programs - the computer program used for the processing of the data shall be fully documented and capable of:

1. listing the input data together with the observed distances, directions and azimuths, and the weights and standard deviation of all observations;
2. performing a least squares adjustment, based on weighted observation;
3. computing plane coordinate values to a precision of at least 1 millimetre, and displaying them in a plane co-ordinate system to at least 1 millimetre; and
4. providing at least the following:
 - adjustment report, including residuals;
 - the variance factors computed from the adjustment results; and
 - relative error ellipsis (95% confidence region) between monuments.

FINAL SURVEY REQUIREMENTS

1. The owner agrees to have his Ontario Land Surveyor provide to the City the registered plan of subdivision, and all other associated plans in digital form, referred to horizontal control survey datum UTM (Zone 17) NAD83 (Original).
2. Before the final acceptance of the plan, the owner's surveyor shall submit to the Engineering Department a report containing a summary of the field traverse, adjustment method, closure report, and a summary of the rationale used to derive the boundary co-ordinates. The surveyor shall provide to the City a signed certificate that his submission to the City complies with the specification set out. The report shall be submitted in paper format. A digital file on 3.5 inch disk or cd is also to be included with the report, and must meet current City digital mapping system standards.

HORIZONTAL AND VERTICAL CONTROL MONUMENTS

Prior to the assumption of the subdivision, the owner's surveyor shall establish a network of second order horizontal control monuments as set out in "Ontario Specifications for Horizontal Control Surveys (OS79)" as well as a network of vertical control benchmarks as set out in "Ontario Specifications for Vertical Control Surveys (OS79)".

The horizontal control monuments and the vertical control benchmarks shall be established at approved locations to the satisfaction of the Director of Engineering, using the following criteria:

- Two horizontal control monuments and two vertical control benchmarks for the first 10 hectares (or less) subdivided by the plan, and one additional horizontal control monument and vertical control benchmark for every additional 10 hectares (or less) subdivided by the plan;
 - In addition, every existing horizontal control monument and vertical control benchmark destroyed during subdivision or site plan construction must be replaced; and
 - The new horizontal control monuments and vertical control benchmarks (including replacements) shall be installed by one of the following methods:
 - a) Make a cash contribution to the City at a rate of \$1,200.00 (including G.S.T.) per horizontal control monument and \$1,200.00 (including G.S.T.) per vertical control benchmark and the City will install the monuments and ensure acceptance by the Ministry of Natural Resources into their Cosine Database.
- OR**
- b) A certificate by an Ontario Land Surveyor be provided stating that the horizontal control monuments and vertical control benchmarks were installed as set out by the "Ontario Specifications for Horizontal Control Surveys (OS 79)" and the "Ontario Specifications for Vertical Control Surveys (OS 79)" respectively and confirmation from the Ministry of Natural Resources that the horizontal control monuments and vertical control benchmarks have been accepted into their Cosine Database.
- The horizontal control monument shall be a round iron bar (.025m x 1.22m) with brass cap or any monument approved by the "Ontario Specifications for Horizontal Control Surveys (OS79)".

MUNICIPAL SERVICE LOCATION

The owner agrees to provide a “digital file” of the subdivision or site plan services to the satisfaction of the Director of Engineering, consisting of all “as constructed” works, including pavement widths, curb types, sidewalks, location of all municipal services, utilities, etc. For major site plans, building locations and parking lots are to be included. The digital data must be compatible with the City of Barrie standards, and must be tied to the horizontal and vertical control COSINE network NAD83 (Original).

SURVEY PLANS

Bearing Note

The plan shall show a bearing note, as follows:

“Bearings herein are grid bearings, and are derived from (specify two or more horizontal control or integrated monuments used for bearing), and are referred to the central meridian (81 degrees of longitude) in Zone 17, and are based on a NAD83 (Original) datum.

Ground Distance Notes

The distance shown on a plan shall be adjusted horizontal ground distance, and the following note shall appear on the plan:

“Distances shown on this plan are adjusted ground level distances, and can be used to compute grid co-ordinates by multiplying by a combined scale factor of _____”.

The combined scale factor applicable to the survey shall be shown in the space indicated at the end of the above note.

Scale Factor

Relationship between any two points on the earth’s surface may be expressed in term of distance and direction. One can determine distance by measuring from a map, or by calculating it mathematically from the grid co-ordinates of the two points in question. In either case it is called the “grid distance”.

The “ground distance” can be determined by physical measurements taken on the ground, in which case it is termed the “ground distance”.

Conversion

In order to convert ground distance to grid distance or visa versa, a scale factor must be applied. The scale factor changes from point to point, but so slowly that in general it may be taken as a constant within any 10 km by 10 km square.

Plan Identifier

The plan shall show the following notes and charts:

- a) “This is an integrated survey plan”; and
- b) Place a UTM coordinate chart with a minimum of two points in an inconspicuous place on the plan and associate these points to the plan with a number or letter.

SURVEY RETURNS

The following survey returns shall be submitted to the City, the client, and a copy retained in the surveyor's file. Specific instructions by the client may require additional items to those listed below:

1. A list of the items comprising the returns.
2. A report which provides a brief resume of the work performed, and outlines the following:
 - a) any unusual problems or difficulties encountered;
 - b) any significant deviation from these guidelines, together with an explanation. The explanation shall include any inconsistencies in the final adjustment;
 - c) an explanation of how the weighing of the measurements was derived; and
 - d) a list of stations held fixed in the final adjustment, together with the source of the fixed values.

DEVELOPER REQUIREMENTS FOR CONTROL SURVEY

Final Survey Requirements

All property surveys required through plans of subdivisions must be tied into the **Ontario Horizontal Control Survey Network (Cosine)** in accordance with Ontario specifications and guidelines and regulations under The Surveys Act (OS 79). In that regard, the owner agrees that an Ontario Land Surveyor will provide to the City the Registered Plan of Subdivision and all other associated plans in digital form referred to Horizontal Control Survey UTM (Zone 17) NAD83 (Original) datum. Prior to final acceptance of the registered plan the owners surveyor shall submit to the Engineering Department a report containing a summary of the field traverse, adjustment method, closure report, and a summary of the rationale used to derive the boundary coordinates. The owner's surveyor shall provide to the City a signed certificate that his submission to the City complies with the specification set out. The required report will be typed and a digital file on 3.5" disk or cd shall also be included within the report and must meet the current City Integrated Control Survey Specifications.

Horizontal and Vertical Control Monuments

Prior to the assumption of the subdivision, the owner's surveyor shall establish a network of second order horizontal control monuments as set out in "Ontario Specifications for Horizontal Control Surveys (OS79)" as well as a network of vertical control benchmarks as set out in "Ontario Specifications for Vertical Control Surveys (OS79)".

In some cases the same monument may be used as both a horizontal and vertical control monument/benchmark.

The horizontal control monuments and the vertical control benchmarks shall be established at approved locations to the satisfaction of the Director of Engineering, using the following criteria:

- Two horizontal control monuments and two vertical control benchmarks for the first 10 hectares (or less) subdivided by the plan, and one additional horizontal control monument and vertical control benchmark for every additional 10 hectares (or less) subdivided by the plan;
- In addition, every existing horizontal control monument and vertical control benchmark destroyed during subdivision or site plan construction must be replaced; and
- The new horizontal control monuments and vertical control benchmarks (including replacements) shall be installed by one of the following methods:

- a) Make a cash contribution to the City at a rate of \$1,200.00 (including G.S.T.) per horizontal control monument and 1,200.00 (including G.S.T.) per vertical control benchmark and the City will install the monuments and ensure acceptance by the Ministry of Natural Resources into their Cosine Database

OR

- b) A certificate by an Ontario Land Surveyor be provided stating that the horizontal control monuments and vertical control benchmarks were installed as set out by the “Ontario Specifications for Horizontal Control Surveys (OS 79)” and the “Ontario Specifications for Vertical Control Surveys (OS 79)” respectively and confirmation from the Ministry of Natural Resources that the horizontal control monuments and vertical control benchmarks have been accepted into their Cosine Database.
- The horizontal control monument shall be a round iron bar (.025m x 1.22m) with brass cap or any monument approved by the “Ontario Specifications for Horizontal Control Surveys (OS79)”.

Municipal Service Location

The owner agrees to provide a “digital file” of the subdivision services to the satisfaction of the Director of Engineering, consisting of all “as constructed” works, including pavement widths, curb types, sidewalks, location of all municipal services, utilities, etc. The digital data must be compatible with the City of Barrie standards, and must be tied to the horizontal and vertical control network as NAD83 (Original) datum in Cosine.

Further information regarding the owner’s responsibility under this section can be obtained through the Engineering Department of the City.