

SPECIFICATION FOR SURVEYING WORKS

1.0 GENERAL

1.1 This specification prescribes the field survey and office works required to compile a survey plan of a parcel of land.

1.2 The following terms are defined as stated, unless otherwise indicated:-

Surveyor: The individual, partnership, firm or corporation, qualified to practice professional engineering or land surveying under the laws of the state in which the property lies, and is contractually obligated to perform the specified surveying services.

True Coordinate Position: The position of a point as determined by field survey originating on a basic control survey marker, and performed to the precision and adjusted as required for basic control surveys.

True Elevation: The elevation of a point as determined by field level circuit performed to the precision and adjusted as required for basic control surveys.

2.0 TOPOGRAPHICAL SURVEY

2.1 Topographical survey shall be carried out for the project site to provide information for the engineer to carry out detailed and accurate assessment on earthwork volume, potential stability issues, slope strengthening options and etc. The topographical survey works shall include but not limited to the followings:-

- (a) Highways, roads, streets, driveways, trails, railroads, bridges, culverts, headwalls, tunnels.
- (b) Building and other structures such as transformers, tanks, rows, paved aprons, locks and dams.
- (c) Shorelines, streams, rivers, ditches, channels and other drainage ways, ponds, lakes and marches, its direction of flow, width, depth, invert levels and depth of water and etc.
- (d) Levels of all slopes and berms.
- (e) Field lines, serial wire lines, pipelines.
- (f) Existing plantation/vegetation such as palm trees, rubber trees, primary and secondary forests shall be indicated. The existing plantation shall be identified such as young palm tree, mature palm trees, old rubber trees and etc. The existing vegetation shall be classified as sparse, bare, dense and etc. Whenever possible, the average height of the plantation such as palm oil, rubber trees, forest shall be measured and included in the drawing.
- (g) Existing extent and invert levels of all drainage system (including intact and damaged drains, sumps, culverts and etc). The sizes and types of drain (earth drain, concrete drain and etc) shall be shown clearly. Where a drain comes to an end point, the end point shall be shown together with the invert level.
- (h) Existing extent of retaining walls such as RC wall, crib wall, gabion wall and etc. The height and length of all retaining walls shall be captured in the survey. The elevation view of the retaining wall shall also be shown.
- (i) The boundary of the project site together with the adjacent lot boundary and lot number. The demarcation lines lying within the survey area such as property lines, set back lines, easement lines, right-of-way lines, political subdivision lines, government land survey lines, associated monuments, etc. shall be shown.
- (j) The coordinates of all boreholes, Mackintosh probes, instrumentation and/or other investigation works at site.

(k) The locations of the TBM and survey markers with coordinates and levels.

2.2 In order to facilitate the study of the catchment area, the topographical survey works shall be matched to the surrounding topographical plan (published by the land survey office or others). Where such information is not available, the surveyor shall provide the distance and levels up to the extent of the catchment area, which is expected to be highest point of the surrounding areas for surface runoff.

3.0 SURVEY FOR FAILURE INVESTIGATION

3.1 Topographical survey for failure investigation shall include the following in addition to the scope of works outlined in Section 1.0:-

- (a) Existing main scarp of failure (if any) and erosion area (with cross sections). Any change of terrain such as a sudden drop of height shall be shown in the survey Drawing. The survey line interval shall generally be 10m or closer for the main scarp and erosion area. The survey line interval shall generally be 25m for areas outside the main scarp and erosion area.
- (b) Signs of erosion especially gullies > 0.5m depth shall be shown in the survey Drawings. It should include the length, width and depth of gullies.

3.2 Apart from the topographical survey, at least three (3) cross-sectional survey shall be carried out within failure zone and two (2) cross-sections at both ends outside the failed scar. The cross-sectional survey shall extended up to the ridge of the slope or as instructed by the Engineer.

4.0 ROAD ALIGNMENT SURVEY

4.1 The objective of the road alignment survey is to survey the existing ground levels across and along the proposed roads at the project site to prevent discrepancies between the topographical drawing and the actual ground levels during the detailed design of the road network and platforms that could have cost implication.

4.2 The survey information is essential for the Engineer to carry out detailed and accurate assessment on earthwork volume, potential stability issues, ease of construction of the proposed roads and retaining structures or slope strengthening options.

4.3 The road alignment survey shall include but not limited to the followings:-

- (a) To locate, pinpoint and provide information on any terrain, rivers, rock outcrops and other infrastructure services (if any).
- (b) To provide cross-sections of the proposed road alignments at 20m intervals.
- (c) To survey spot levels along the cross-sections at maximum 5m intervals up to 30m beyond the edges of the road shoulder. However, the interval of the spot levels shall be varied based on the condition at site. If required, closer spacing shall be surveyed where the terrain is not uniform, such as deep gullies and creek areas.

4.4 Survey pegs for the center line of the road shall be left at site with clear and concise labelling.

5.0 WORK REQUIREMENTS

5.1 The surveyor shall perform all field survey and reconnaissance work required to establish horizontal and vertical control sufficient to achieve the specified plan accuracy. Perform sufficient supplementary field survey work to ascertain the true horizontal and vertical location of existing features when an accurate location cannot be determined by the mapping technique used such as culvert sizes and inverts for plan prepared by serial photogrammetry. If local

standards/practices have more stringent requirements than specified herein, they will be followed.

- 5.2 The surveyor shall maintain clear, neat and legible field notes showing all measurements made, together with sufficient sketches and narrative descriptions to ensure that the work performed can be accurately interpreted by anyone familiar with common surveying practices and procedures. Submit to engineer one copy of all field notes.
- 5.3 Perform field survey work with sufficient precision to ensure that the required accuracy of the finished plan is achieved. The computed coordinate position of each horizontal control point used in compiling the plan shall be correct within the limits of second order accuracy (that is, the horizontal error of closure of the control transverse shall not exceed 1 in 10,000 and the angular error of closure shall not exceed 1 minute times the square root of the number of instrument motions in the traverse, all before adjustment. The vertical error of closure of the control level circuit for the control benchmarks shall not exceed plus or minus 5.0 millimeters times the square root of the length of the circuit in kilometres, before adjustment). Both the horizontal and vertical measurements shall be expressed to the nearest millimetre.
- 5.4 The surveying works shall include but not limited to the followings:-
- (a) Re-establish the project boundary stones.
 - (b) At least four (4) benchmarks shall be established using Global Positioning System and electronic survey total stations, in which the position of all survey works and detected objects shall relate.
 - (c) The benchmarks shall be established on stable ground within of adjacent to the project site. The benchmarks shall have reference numbers, coordinates and heights above Survey Department's datum and be clearly shown on the plan.
 - (d) Relating attribute data to the objects detected, i.e. width, length of rivers and boundary of rock outcrops shall be logged and retained wherever and whenever possible.
 - (e) Be accurately plotted contour lines and spot elevations, the plan shall depict the true topographical character of the area. Show existing contour lines at 2.0 meter interval. Spot elevations shall be taken on a 25 meters grid maximum for slopes greater than 5% and a 12.5 meters grid for slopes flatter than 5%. Show spot elevations at all high points and low points, and at points of grade changes between contours as necessary to accurately depict irregular terrain features. All measurements shall be within +/- 5 millimeter accuracy within the survey area.
 - (f) Coordinate grid system shall be indicated on the plans on which the survey is based and the permanent benchmark monuments to which the field work is tied for horizontal control. Show the grid on the plan by grid lines plotted at uniformly spaced coordinates at intervals of 50 meters.
 - (f) To update the existing topographical drawing

6.0 SUBMISSION

6.1 Materials of deliverables

Drawings: New drawings shall be 841 millimeters x 1189 millimeters bearing the standard title block of surveyor and certification for survey work performed.

Magnetic media: Magnetic media on which digitized data is delivered shall be on CD Rom (suitable for use on AutoCAD latest version).

6.2 All the survey Drawings shall be submitted in both hard and soft copy. The survey drawings and relevant information as followings shall be submitted:-

- (a) Three (3) sets of A1 size plan endorsed by the licensed surveyor including soft copy (AutoCad Release 14 or above format) of the followings:-

- Spot height along the cross sections.
 - Labelling of the chainages.
 - Locations of rivers, rock outcrops and etc. with colour-coded for easy recognition.
 - Major contour at 10m interval and minor contour at 2m interval.
 - Project site boundary.
 - All surveyed cross sections.
- (b) Ground model in MOSS Genio format of the followings:-
- Spot heights and coordinates along the cross sections
 - Spot heights and coordinates of the cross sections baselines.
 - Contour model with major contour at 10m interval and minor contour at 2m interval.
- (c) Schedule of benchmarks (TBM) with the reference numbers, coordinates and heights above Survey Department's datum. Description and location of the benchmarks shall also be submitted.
- (d) Original copy of the survey field logs/log books duly endorsed by the Licensed Surveyor. All survey data including corrections or errors shall also be clearly indicated in the log books. Certificates showing that the surveying equipment used have been calibrated in the last six (6) months shall also be attached. These certificates shall also be submitted prior to start of work.
- 6.3 All rate quoted in the respective items in the Bill of Quantities shall deem to include the prices of fulfilling of the aforementioned requirements.

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