

A1) Can you carry out "3D topo-survey for road design"?

Yes

A2) If your answer is "YES", please describe standard process of "3D topo-survey for road design".

Refer to the map provided, the road alignment had been designed. In order to provide terrain information along the proposed alignment, 3D topographic survey should be carried out for future design or construction purpose. It is noted that the total length of the proposed alignment is approx. 130km, depends on the actual site condition the field survey could be conducted by survey methods such as traditional ground survey method, aerial photogrammetry or airborne LiDAR. An accuracy of better than $\pm 0.1\text{m}$ could be achieved in XYZ directions. We suppose the design and revision of road design should be carried out by Civil Engineer. The 3D topographic survey data is used to facilitate the design and for future construction used. The surveyed data will be presented in 3D coordinates in software such as AutoCAD Civil 3D and MicroStation. Terrain model, cross section and road profile could be created by commands associated with the software.

A3) Provide some evidences and/or samples you carried out "3D topo-survey for road design" in the past.

We have experience in proposing two MTR (Mass Transit Railway) tenders regarding "3D topo-survey for road design" in 2008 however both were unsuccessful. (Probably due to cost) The projects were design studies for the construction of Express Rail Link and Shatin to Central Link. In these projects aerial photogrammetric survey method was proposed due to the large extent of survey area involved. (approx. 150ha) Supplementary detail ground surveys were requested for specific locations where detail studies were necessary. A location plan showing the proposed alignment of Express Rail Link could be found in NEX1.pdf.

A recent survey (client: CEDD government dept) that we carried out as a sub-contractor of the project also required 3D topographic survey and presentation of surveyed data in digital model. This project involved airborne LiDAR survey to cover the whole territories of HK, however the aim of the project is not for road design purpose. General specification of the project could be found in CEDD1.pdf.

B1) Can you carry out "building/editing of DTM"?

Yes

B2) If your answer is "YES", please describe standard process of "building/editing of DTM".

Up-to-date elevation data is a critical component for the majority of mapping functions within the project area. In order to represent the actual terrain of the site, topographic survey results in 3D coordinates ASCII files will be input in software – MicroStation Inroads. 3D topographic survey results could be acquired through ground survey method (by total station), laser scan, LiDAR etc. To convert surveyed points to surface 'triangulate surface' command is used. Since the 3D coordinates of each triangle's vertices are known, the elevation of any point on the resulting triangular plane can be

computed through interpolation given its 3D coordinates. The generated surface could be edited by modifying individual points, triangles and portions of surfaces through commands such as 'merge surface' 'delete triangle' and 'insert breaklines'.

B3) Provide some evidences and/or samples you carried out
"building/editing of DTM" in the past

We have experience in creating and editing DTM for various projects. We conducted hydrographic surveys for the Drainage Services Department in 2008 and 2009. Spot levels of rivers' cross sections were surveyed by ground survey method and single beam echo sounder. The surveyed raw data was processed by software - Liscad to generate 3D topographic plan. The data was then input to software - MicroStation Inroads for creating DTM. Total length of rivers surveyed in each project was about 20km.

Creating DTM is useful in these projects as cross sections (part of the contract requirement) could be generated easily from the DTM and it also facilitated the calculation of sediment volume and perform comparison between seabed surface in different years. Scope of work of this project is attached for reference. (DSD1.pdf)

We also conducted coal volume measurement surveys every year for CLP (China Light and Power). In these projects, DTM of existing coal surface was created by the surveyed spot levels. The surface/as-built DTM was used to overlay with the design DTM for calculation of coal volume by mean of 'end-area volume' or 'grid volume' methods.

Data processing and editing functions were performed in the MicroStation Inroads environment.