SAFE, ACCURATE AND CHEAP MAPPING OF TRANSPORTATION CORRIDORS

Helicopter Photogrammetry

Surveyors working on busy roads are constantly subjected to close misses from passing traffic; it can be worse. Helicopter photogrammetry is a survey technique designed to prevent fatalities. A complete, dated record of the project area can be economically delivered and accessed at will without having to revisit a dangerous survey site. The authors describe this solution.

Terrestrial surveying on fast-moving transportation corridors often means lane closures and roadside work zones but despite these precautions they still remain dangerous places to work in. Traffic management is very expensive and can have a severe impact on the project budget. Lane closures result not only in a series of direct costs involving safety personnel, cars and portable traffic signals but also in indirect costs linked to traffic congestion and potential accidents. The difficulties and expense of regulated ground survey operations often result in compromise between safety and accuracy, one being sacrificed at the expense of the other. As safety is statutory, programme accuracy becomes refined to meet the budget, thus compromising the value of the project.

Helicopter Use

Conventional photogrammetry has long been used to map large or isolated areas difficult to access and practically or economically unfeasible for standard ground-survey techniques. The mapping industry has historically used vertical photography acquired from fixed-wing aircraft for mapping applications, delivering the accuracy required to meet conventional scale map specifications. To achieve the vertical accuracy requirement for transportation surveys using photogrammetry air photo acquisition has to be at an altitude neither suitable nor permissible for fixed-wing equipment under existing regulations. A helicopter capable of operating within the altitude regulations was identified for use as a camera platform. The use of a twin-engine helicopter further ensures certification for operating in populated areas and transportation corridors, thus meeting the needs of our project applications.

External Mount

The mount was designed as an exterior fitting for a specific helicopter, such that no adaptation of the airframe was required. This enables efficient fitting and dismantling of the system, minimising the time commitment of the helicopter. Implementation of a large-format aerial camera was defined as an alternative to a small format. This 23cm x 23cm camera format was chosen specifically to provide total coverage of the transportation corridor, permit(s)ting displacement of the network of survey control beyond the travelled portion of the project. Table 1 describes the coverage achieved from a given photo scale using the current camera configuration.
With appropriate ground control, a ±5mm vertical pointing accuracy can be achieved on a clearly defined surface from the flying height of 75 metres.

Ground Control

Fieldwork is unavoidable in mapping, even when the most innovative remote sensing technologies are applied. Ground control points need to be collected to tie the aerial images to real-world coordinates. However, use of a large format means that most fieldwork (targeting, GPS measurement and precise levelling) can be organised from outside the mapping area. For example, for the mapping of railway infrastructure the surveyor can position ground control outside the project corridor, negating the need for the support of lookout personnel. The specified final accuracy of a project will define the scale of the imagery to be used for the photogrammetric process. It is crucial that network spacing of the ground control is defined by stereo-model coverage of the chosen photo scale. A failure to provide sufficient control for the project can compromise the capability of photogrammetry to deliver the required project pointing accuracy. Once these criteria are determined, a project-wide network should be defined to best fit the designated flight-line coverage of the project area. As only a network of stations is required, rather than continuous terrestrial survey, the time needed to complete the fieldwork is minimised. Thus, should limited track access be required it can be organised at a time of day with least traffic.

Photogrammetric Data

The benefit of using a standard aerial camera is that standard photogrammetric principles and procedures apply. The mapping process can be achieved through the use of digital or analytical photogrammetric workstations. Imagery is processed through aerial triangulation to establish stereo-model control from the ground survey network. The stereo models are then restituted in the appropriate workstation, where the photogrammetric compiler can capture the three-dimensional data of relevant features to meet project specification. Due to the scale of the project imagery, the level and size of features that can be identified allow for a detailed asset management tool to be obtained at a very high level of accuracy.
The use of the full-format metric camera offers optimum resolution for photo interpretation. Surface analysis will be based on a homogeneous digital photo mosaic. This approach using aerial capture of surface data delivers terrestrial accuracy with minimal traffic-management costs and optimum safety to ground-based support personnel.

Possible Applications

The system is primarily developed for large-scale mapping of infrastructure corridors such as railways and roads. Here

helicopter photogrammetry allows for a wide variety of applications in the development, planning and engineering sectors; these include land use and environmental databases, emergency services, asset management, precision surface measurement, and utility inventory. Due to the scale of the imagery, precise, three-dimensional data on small features can be delivered, providing previously unavailable information required for numerous applications. Surface maintenance, including volume computation of resurfacing materials, becomes feasible through the delivery of a precise surface model. In terms of asset management or engineering analysis, the coverage of the image using large-format camera generally delivers total-corridor coverage in a single pass and the ability to interpret the smallest of structural features.

Concluding Remarks

The system described here is owned by Global Topographic Services Ltd (UK) and is operated in Europe as [HELI-SURVEY]. It has been used successfully on a number of projects in the UK, Australia and The Netherlands over the last year of operations.

---

https://www.gim-international.com/content/article/helicopter-photogrammetry