Development of a Template for the Preparation of a Survey Brief

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ABSTRACT

With the current 'right sizing' of many organisations (both government and private), a significant amount of survey work that was previously carried out in house is now being carried out by contractors. The common protocols that guide these practices require competitive market practices. The result of these two cases is that survey companies are frequently bidding on work and others are trying to assess that the right survey will be undertaken in the right manner. The authors have faced a similar situation, with no in-house field survey capability. Survey tasks are outsourced and the challenge has been to get the right survey. This paper describes many of the areas where assumptions from the client were not matched with the proposed survey methodology of the survey company and how these conflicts can be removed with careful detail in a survey brief. There are also many associated issues that can affect the conduct of a survey. This paper lists many such areas for consideration for inclusion in a survey brief. This list can become a template for the preparation of such a brief. Results to date have been very positive with survey firms having a clearer understanding of what is required and project managers having a clear understanding of what they are getting.

KEYWORDS: *Survey brief, instruction, sub-contract*.

1 INTRODUCTION

Are your survey resources being constantly cut? Do you often here comments like "*Why do we need our own surveyors?*" or "*Why don't we just contract in the survey resources as we need them?*" Are you looking for work outside your regular (often internal) clients? Do you respond to tenders and requests for quotes for survey work? If the answer to any of these questions is yes, you will have or are likely to come across issues that have faced the authors of this paper over the past few years.

There are three major areas to be covered in a survey brief. These are the administration (including safety and permits), the type of survey, and the deliverables. Each of these areas may have a number of sub-areas to be covered in the brief. Each area is briefly covered in this paper. Those preparing a survey brief should consider each of the sub-areas for potential inclusion in the brief. A summary list that can be used as a checklist is also included. This list is still growing but has proven useful in creating survey briefs that are now much clearer than those being supplied at the beginning of this process.

2 ADMINISTRATION

The administration section of the brief should cover all the processes and details required to understand what is required and what the surveyor should do when something unexpected happens. All safety requirements appear in the administration section. This section also covers what documentation needs to be in place before the survey begins.

2.1 Purpose of the Survey

The purpose of the survey should be clearly stated. This will aid in the interpretation of many other sections of the brief and help the surveyor to identify any details found in the field that were not known when the brief was prepared. This should be short and succinct so that it can be kept in mind throughout the survey.

2.2 Overall Location of the Survey

The overall area and location should be made clear. Often mark-ups on existing mapping can be useful. In NSW, more detailed background information for Google Earth is now available through the NSW Globe dataset (LPI, 2014b). A similar dataset is available for Queensland. This mark-up should show the area of the main survey, together with sufficient information to find the site. The mark-up may also include access points to the site and any other key locations within the site.

2.3 Contact Person for Technical Input and Decisions

The contact person for technical input should be clearly identified to allow rapid resolution of any technical issues during the survey. Details should include email and mobile phone numbers where appropriate to aid in information flow and timely responses.

2.4 Contact Person for Administration and Finance Issues

The contact person for administration and finance should be clearly identified to ensure correct information flow during the survey. Again, details should include email and mobile phone numbers where appropriate to aid in information flow and timely responses.

2.5 Safety Requirements to be Followed

There have been a number of papers presented on work health and safety for surveys over the years. Some surveys may need to incorporate a number of areas including roads, railways and underground services. Other possible areas include remote areas, sensitive areas and fire prone areas. Any safety systems that are to be incorporated in the surveyor’s safe work methods should be listed in the brief.

2.6 Inductions Required to be on Site

Many sites require some form of induction before personnel are allowed to work on the site. These inductions may be carried out on site or they may be conducted at a separate location. Details should be provided to allow more certainty in the response to the brief.

2.7 Protocols Before Entering the Site

Some sites will have protocols to be followed before entering the site. For surveyors who are often on site before site compounds are established, these protocols may include notification to a central office of the entry and exit to the site. Each site is unique, and the specific protocols should be stated in the brief.

2.8 Protocols to Follow Before Entering Private or Restricted Lands

Surveys often extend into adjoining lands. Often the project team includes people charged with managing the relationships with the adjoining land holders. Such teams will have established protocols to be followed. These protocols should be clearly stated in the brief.

2.9 Protocols Before Placement of Survey Marks

There may be specific protocols to be followed before placing survey marks. These would be in addition to the Dial Before You Dig (DBYD) requirements. Any such protocols need to be clearly stated as the placement of survey control is often one of the early tasks in a survey.

2.10 Required Qualifications of Key Personnel

There may be qualifications required for key personnel. These qualifications need to be detailed, including any restrictions on the makeup of a field party. An example of this might be that a particular qualification (or level of experience) must be in the field whenever certain tasks are being undertaken. Consideration could also be given to possible audit of such a requirement.

2.11 Required Insurances

The survey company will be required to have certain insurances. The level of these insurances needs to be stated. Examples of these could include professional indemnity, public liability, WorkCover, vehicle and equipment.

2.12 Documentation to be Provided Before Personnel go to Site

Project teams often require some documentation to be supplied to the office before the commencement of any survey work. Some documentation will be required to be with the field party on each day of field work. Items in this section could include:

- Safe Work Method Statements (SWMS).
- Permit to break ground.
- Copies of insurance certificates.
- Any required permits to work.
- Documentation to be with the field party.

3 TYPES OF SURVEY

There are a number of different types of survey that might be required. Each of these appears in the template together with the details that are typically required for each type.

3.1 Control Survey

The first type of survey required is a control survey. Some amount of control is required in most surveys but the clients often do not consider control surveys or are not concerned about the control. In most engineering surveys, the surveyor is in the early groups of people to visit the site and the purpose of the survey is to gather information to enable design of various types, through the various design stages and into the construction, and often ongoing maintenance over the infrastructure lifetime. Establishing sound control to the appropriate accuracies for the various stages of the project can be seen as unnecessary expense up front. Managing the client expectations at this stage can produce a solid foundation in ensuring spatial correctness for all future surveys.

Consideration needs to be given to the durability of the control marks, the ready identification of control marks in future stages, the location of the marks from a usability point of view through all stages of the project, and public access to control marks during and after the project. The surveyor will require specific instruction on each of these aspects of the control survey marks to be placed.

The accuracy of the control survey needs to be specified. This specification could be a particular class of survey as defined in ICSM's standard for control surveys (ICSM, 2013) and NSW Surveyor General's Directions (Dickson, 2012; LPI, 2014a), e.g. to allow new control to be included into the state's Survey Control Information Management System (SCIMS), or other levels as required for the project.

3.2 Coordinate System and Datum

The choice of coordinate system and datum should be made early. For detailed discussions on this topic, the reader is referred to the available literature (e.g. Janssen, 2009; Butler, 2012; Haasdyk and Janssen, 2012). It may be necessary to bring control in from nearby or some distance away. If the control coordinates are to be used for a long-term project, there may be requirements to ensure a reliable source that can be re-established is used. There may be legislative requirements for using a particular system. Surveys for NSW government and local government are required to meet the Surveying and Spatial Information Act and the accompanying Regulation (NSW Legislation, 2014a, 2014b). This may mean that legislation requires to use the Geocentric Datum of Australia (GDA94). In a similar way, some organisations have standards that require particular coordinate systems and datums. For example, the Australian Rail Track Corporation (ARTC) standard ETD-00-04 (ARTC, 2011) allows surveys to be performed on the Map Grid of Australia (MGA94) and the Integrated Survey Grid (ISG). Linear coordinate systems may also be required. This is typical for infrastructure surveys of linear assets like road, rail, pipeline and transmission line surveys. The origin of this linear coordinate system should also be specified.

3.3 Surface Detail

Survey information to define the ground surface may be required. The brief needs to indicate the accuracy that the surface definition needs to be captured to, and the interim and final products to be produced form this information. Additional built environment information including top and toe of batters, drains, paths and roadways, changes in surface type (concrete-asphalt-grass), buildings, pits and cable routs, poles and aerial wires, fences, walls and sometimes site specific information may be required. Sometimes it may be sufficient to

indicate that something is there and at other times specific identification is required. Specific identification will often require some type of library describing the name (code) and properties. This can be in the form of photographs of typical infrastructure and the name. When unusual items are found, the brief should require that the survey include a photograph of the item to allow later identification.

Some additional information may also be required for some infrastructure. This might include measurements around a headwall including the size and shape of the opening or attributes like the text on a sign or names of buildings or pole numbers. Specific trees may need to be individually located. These trees should be identified in the brief or the properties that make a tree one that needs to be individually located.

3.4 Engineering Detail

Specific engineering detail may be required. For a pipeline survey this might have to do with an existing pipeline and the associated infrastructure, for a road widening the existing pavement extent and level, and for rail the existing rail and clearance infrastructure. The brief needs to identify the engineering information required, the accuracy requirements which may be different to other detail, and specific information about the existing infrastructure.

3.5 Built Environment – Buildings, Bridges and Other Structures

There can be various requirements for items of built environment. These requirements may lead to special data collection including terrestrial photogrammetry, terrestrial laser scanning, fine and detailed measurements of infrastructure not visible from a survey instrument (e.g. bridge bearings). Survey information may also be required for the inside of buildings, the change in building finish, and evidence of date of construction.

3.6 Underground Services

Surveys for the purpose of engineering design often require the location of underground services. These services need to be located by authorised personal. There may be a range of services and not all locators are authorised to locate all services. Recently AS 5488-2013 Classification of Subsurface Utility Information (SUI) was released (Standards Australia, 2013). This standard covers many of the issues in surveying underground services from spatial location through to service metadata. The survey brief needs to cover who engages the service locator, and the type of location required (remote detection or physical exposure). The accuracy of service location needs to be specified and any special detail that may be required for the particular survey.

3.7 Aerial Photography

Although aerial photography libraries now cover an extensive area, some projects require updated aerial photography and often at a higher resolution. When aerial photography is required, the brief needs to cover the age, the resolution, spatial accuracy, and the ground model resolution for ortho-rectification. There should also be some direction to do with shadows and time of day for photography.

3.8 LiDAR

If LiDAR is required, the brief should clearly indicate the extent of the LiDAR coverage, the

accuracy and density of the LiDAR data and the deliverables. Any necessary ground truthing of LiDAR data should be specified, together with how this should be compared. It is recommended that some ground truthing in the form of cross sections across the flight lines be considered to ensure that both datum and tilt errors are kept within desirable parameters.

3.9 Cadastral Survey

Most engineering surveys require some form of boundary location. The boundaries may need to be located for identification purposes, or if there is planned infrastructure near the boundaries, they may need more extensive definition. Some projects may also include land acquisition and also establishment of temporary leasing of surrounding land areas to allow for vehicle movement, stockpile and site compounds during construction. The survey brief needs to indicate the extent of the boundary definition required and the purpose of this definition to allow the surveyor to carry out the appropriate level of work. There are also increasing requirements for the preparation of a Survey Accurate Cadastral Model (SACM) covering a project. Again, the extent and purpose of such a model needs to be stated, together with the attributes that are required for each boundary and land parcel.

3.10 Monitoring Survey

When monitoring surveys are required, the survey brief needs to indicate what is being monitored, and what movements are expected. The rate of movement and the pattern of movement will also need to be given. The brief should also indicate the time frame that the movement is expected to occur over and any possible zone of influence. The brief should also specify the minimum number of base epochs to establish a base and noise level before engineering works that might cause movement can commence. The survey can then be designed to include sufficient stable survey marks and well-designed techniques to provide the sensitivity required to detect the expected movements.

3.11 Asset Mapping Survey

Asset mapping surveys often require different accuracies. Asset mapping surveys need a library of assets to allow field identification, together with a list of attributes for each asset and the possible values for each attribute. Where the accuracies or geographic extents differ between different assets, these need to be clearly stated. The library of assets should include a photo example of each type of asset (or more than one photo if there are variations for a particular asset type like variations in cars, i.e. all are cars but the can look very different).

4 DELIVERABLES

A number of different deliverables may be required. Each deliverable should be listed in the brief to avoid later difficulties where the client expected one thing and the surveyor expected a different thing.

4.1 Plans

Most surveys require delivery of plans. Such plans need to be specified. The plans can be delivered in hard copy or soft copy. It should be stated at what size the plans are to be prepared (typically A3 or A1 but other sizes might also be specified). This is relevant even when soft copies are specified as it will dictate text sizes that are readable without having text

overwriting. The scale of plans should also be specified. If required, one should allow for detail plots at smaller scales. The client (or project) may also have a document management system that specifies drawing numbers. If this is the case, the brief should indicate the numbering system and either allocate available drawing numbers or give details about how these numbers are to be numbered. Some clients also specify particular title blocks to be used and rules for what goes where in the title block. If this is the case, the brief should include this information or a reference to this information.

4.2 CAD Files

Most surveys for engineering purposes are also required to be delivered as Computer-Aided Drafting (CAD) files. These CAD files are used as a background to the design, and data is often extracted into design software. Some projects and client organisations also have CAD manuals that specify how survey information should be delivered in the CAD files. If this is the case, the survey brief should include this information or references to this information. Often the final plans need to be delivered as one CAD file per drawing. This may require two sets of CAD files to be delivered. The format of the CAD files and the version should be included to ensure that those receiving the data can correctly read the data and not require any translation.

Where the survey includes a surface model, the brief should include a separate triangle file for the surface model to ensure that designers use the surface supplied by the surveyors and not one they have created themselves. Break lines should also be supplied together with an external boundary of the surface model.

4.3 Survey Report

One or more reports should be specified. There could be a report or section of a report for each type of survey. These reports are valuable to the users of the information as they give the surveyor an opportunity to pass on any information about limitations of the survey due to field conditions present at the time of the survey. This could include comments like long thick grass that made the ground surface not visible and therefore less certainty of the surface in between the survey points. The report may also indicate areas where the surveyor was unable to detail a limited area due to some onsite issue that may include flooding, unstable ground, archaeological or environmental restrictions.

4.4 Reports

There should also be a number of reports. These could include daily logs of the field work indicating date, time, start, finish and any unusual incidents, contact with neighbours and the public, any delays caused by outside influences, safety incidents or near misses, and any other incidents that might be relevant.

4.5 Survey Control

Reports should include adjustment reports, sketches and photos of control marks and also a control survey plot showing the network. In some cases, the survey observations used in the adjustment can also be a deliverable. If this is the case, the format should be specified in the survey brief, or how this is to be agreed. A final list of the survey control marks and their coordinates should also be supplied as a text file or spreadsheet.

4.6 Detail Survey

During the course of a detail survey, often some unexpected infrastructure is encountered. This may not be covered in a specified coding system. When this is the case, the survey report should identify such infrastructure with a photo and assign an unused code for this infrastructure. There should also be direction on how to show any attributes collected in the engineering detail. It should also be specified how profiles are to be presented.

4.7 Re-Survey

During the course of a detail survey, sometimes a re-survey is required due to a change in the surface during the survey. When this occurs, the survey report should show the extent of the re-survey.

4.8 Access Issues

During the course of a survey, sometimes access is more difficult than expected. This might be due to geography or it could be due to human interface issues. In both cases the report should indicate what difficulties were encountered and what solution was implemented to overcome the difficulties.

4.9 Aerial Photography

The format of the aerial photography should be specified. This could include any required tiling, geo-referencing and compression.

4.10 LiDAR

The brief should indicate what LiDAR processing should be carried out. The supplied data could include a raw point cloud, a classified point cloud, a subset ground surface point cloud, and a Digital Elevation Model (DEM) at a specified resolution.

5 SURVEY BRIEF CHECKLIST

5.1 Administration

In regards to administration, the following items should be covered in the survey brief:

- Purpose of the survey.
- Overall location of the survey – use existing maps / aerial imagery.
- Contact person – technical.
- Contact person – administration.
- Safety requirements – including dedicated safety personal if required.
- Required inductions, including safety inductions.
- Authority to enter site.
- Authority to enter adjaent lands.
- Approval before placement of survey marks.
- Qualifications of key personnel.
- Insurances required.
- Documentation pack before commencing survey – SWMS, permits, insurance certificates.
- Documentation to be carried in the field.

5.2 Survey

Control survey items to be covered in the brief:
- Geographic extent of control survey.
- Types of control marks.
- Locations (or frequency) of control marks.
- Accuracy of control survey.
- Documentation of control marks.
- Documentation of control network.
- Documentation of control adjustments.
- Coordinate system and datum.

Surface detail items to be covered in the brief:
- Geographic extent of the surface detail.
- Accuracy and any variations.
- Library of infrastructure.
- How additional information is to be captured.

Engineering detail items to be covered in the brief:
- Geographic extent of the engineering detail.
- Specific engineering items to be located.
- Required attributes for each type of item.
- Accuracy requirements for each type of item.

Built environment items to be covered in the brief:
- State items of built environment having special requirements.
- Purpose of the survey of the items of built environment.
- Specific parts of the items to be located.
- Required attributes for each type of item.
- Accuracy requirements for each type of item.

Underground services items to be covered in the brief:
- Geographic extent of the underground service survey.
- Purpose of the survey of the underground services.
- The coding and identification required for underground services.
- How services that could not be located should be indicated on the output.

Aerial photography items to be covered in the brief:
- Geographic extent of the aerial photography.
- Age of the aerial photography.
- Resolution of the aerial photography.
- Spatial accuracy of the aerial photography.
- Ground model to be used for ortho-rectification.

LiDAR survey items to be covered in the brief:
- Geographic extent of the LiDAR dataset.
- Horizontal and vertical accuracy.
- LiDAR density.
- LiDAR check survey.

Cadastral survey items to be covered in the brief:
- Geographic extent of the cadastral survey.
- Purpose of the cadastral survey.

Monitoring survey items to be covered in the brief:
- Extent of the monitoring survey.
- Expected movements.
- Expected time frame of movements.
- Expected stable areas.

Asset mapping survey items to be covered in the brief:
- Geographic extent of the asset mapping survey.
- Spatial accuracy for each type of asset to be mapped.
- Library of assets to be mapped and how to recognise assets.
- Attributes and pick lists for each asset and field.

5.3 Delivery Documentation

Delivery documentation to be covered in the brief:
- Logs of daily activity in the field.
- Logs of any issues.
- Reports for each type of survey.
- Hard copy plans.
- Soft copy plans.
- CAD files.
- Models.
- Sketches.
- Aerial photography.
- LiDAR.
- Cadastre.
- Assets with attributes.
- Monitoring and movement detection.

6 CONCLUDING REMARKS

The checklist presented here is both a generalised list and a live document. As further areas of misunderstanding come to light and as new types of surveys are considered, the list will alter and grow. There are also sub-sections for more specific surveys that contain more detail than is appropriate in such a generalised list. This list has come about as two parties have interpreted requirements differently and friction has occurred. The result of having a detailed survey brief provides both a more harmonious and efficient use of specialist survey resources. The list presented here will continue to grow as long as those preparing survey briefs understand the survey environment and field surveyors keep up an open dialogue with the clients.

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