Registration Renewal

Career Episode Report (CER)

Competency Element	**Dates of Career Episode:** 04-2013 – 06-2013
	Abstract: 23KM CONTROL TRAVERSE & PLACEMENT OF TCM's
Type the Element references here S 2.4 i S 3.4 ii S 5.1iii S 2.3 i S 6.1 i S 4.4 ii S 4.5 iv S2.4 i	The company for whom I am employed is presently on the tender panel of [redacted]. In early April 2013 I received an email requesting a lump sum fee price for a Ballast Cleaning & TCM replacement survey. The tender comprised of 7 separate sections of track, each being approximately 20km in length. The projects involved establishing a control network, by connecting into the existing survey control monumentation along the rail line, as provided by [redacted], and adhere to [redacted] "Control Surveys EDT-00-04" procedure to establish a control network along the entire length of the project to facilitate the placement of TCM's (Galvanized Iron Pipes) at all TP, TRS etc. at 50m interval on straights and 20m intervals on curves. In additional to the placement of the TCM's, the track adjacent to each TCM is required to be located, enabling the calculation of the existing track alignment and therefore to calculate of the "pull" (horizontal shift) and "lift" (vertical shift) to place the track back to its original design position during the ballast cleaning process. As the Survey Manager, I have many and varied tasks, including but not limited to, preparing fee proposals, scheduling of resources, client liaises, ensuring Work Place Health and Safety is adhered to, managing the project to ensure projects are delivered on time and on budget, survey is completed using best method practices and observe the regulation, mentoring of staff and taking responsibility for the project. In preparing the tender there were many considerations, allowance of job initialisation, safely requirements, appropriate inductions, field preparation and calculations, mobilization, establishment of the survey control, setting the TCM's, per diem, accommodation, project management etc. I began by completing a project initialisation form, thereby obtaining a project number. The email requesting the tender contains numerous documents pertaining to each tender, to simplify and manage the project I created 7 separate work orders, one for each tender and placed the appropriate files within each work order. [redacted] provided an existing control sheet for each section, on the Integrated Survey Grid (ISG) for New South Wales Zone 56-1 coordinates system. I created a "csv" file of each section; for section 1 I numbered the points in 100 point range, section 2 the 200 point range and so on to enable a quick visual determination of each tender section. Using Trimble Business Centre (TBC) I imported each of the "csv" files and placed each on a separate layer, relating to the tender / workorder. When creating the TBC project I specified the mapping Projection ISG NSW – Zone56-1 and assigned the geoid (AUSGeoid09), hence when I exported the control points into Google Earth, the points are depicted in their correct spatial position, thus enabling me to gain an appreciation of the location of the project, terrain of the project, its constraints and to estimate the survey work involved in establishing the survey control network in accordance with [redacted] "Control Surveys EDT-00-04" procedures. The procedures require control to be placed at no more than 200m interval. I needed to allow for time to recover the existing control, set the additional control monuments, traverse through the control and then using CompNET calculate a least Squares adjustment, per [redacted] tender specification. In addition I estimated how many TCM's we would set on average per hour making allowance of travel to and from site each day and calculate how many TCM's were in each section. Once estimating of how much time each field component should take, I applied our hourly rate fee to determine cost. I then needed to make allowance for project initialisation, inductions, field preparation and calculations, mobilization, accommodation, processing and QAQC of the data and preparing the final deliverables. Due to the considerable size of the project, I deemed it would be sensible to drive the length of the project and evaluate each section. Upon the reconnaissance of the project

S 5.1 i, iii	I revised certain aspects of our estimate based upon constraints, such as difficultly or lack of access and made a decision on which tender section we would prefer to be awarded. We submitted a tender for all 7 sections on April 18th 2013.
S 1.2 i, ii S 5.1 i S 1.2 ii	On April 29th 2013, I received a phone call from [redacted], inquiring if the company was still interested in providing the surveying service of the project and if so, how many sections would we be interested in. Having just committed several survey crews to another project, I proceeded to make several phone calls to senior management and other survey managers at other locations, to determine what resource the company had available at present and to determine if we could undertake multiple sections. I contacted [redacted] to inform them that although we would like to take on several sections, we only had the resources at that point in time to undertake one section. I would prefer to do one section correctly rather than two sections poorly, as a good performance is very likely to lead to additional works in the future that is not based solely upon price but on the quality of service provided. [redacted] emailed me the official offer letter on May 1st 2013 awarding a tender for a single section, being our workorder 6, approximately 23 km in length.
S 5.1 iii S 2.4 i	The first item to address was to have the contract signed and provide the appropriate "worker compensation certificates" and "Confirmation of Insurance - Liability". Once all the required documents were provided to [redacted] they issued a "Letter of Engagement" thus allowing us to formally proceed with the project.
        S 3.4 ii	Next I needed to determine how to resource the project, taking into consideration the skill set of each surveyor, availability to work remotely and annual leave schedules. Due to personal scheduling conflicts, the surveyor to who I wisded to manage the project was unavailable. The most suitable surveyor and chainman (Crew A) for the project were based in our [redacted] office; however they both needed to obtain the applicable safety cards to work on the railway in NSW. The process involved arranging drug / medical tests, full day rail safety courses "Rail Industry Safety Induction", additional "One Track" induction and an online [redacted] induction. Once the various inductions were completed and induction cards issued, they needed to provide the inductions card and proof of ID to an accredited Post Office to obtain an "Onsite Track Easy" card, which would allow them to work within the rail corridor in NSW. Fortunately, the other survey crews that I had earmarked for the project had previously gained their "Onsite Track Easy" cards and were still current.
S 6.1 i S 2.3 i, iii S 4.5 iv S 2.3 vi	While Crew A was undergoing the induction process, I began planning the methodology to perform the control survey. I choose the software, Trimble Business Centre (TBC) which to manage the survey data for a variety reason, firstly it's functionality to process GPS observations, secondly the traceability TBC provides being able to view vector data and its associated information, thirdly I have use TBC previously to store the raw data and then to export the points to the suitable software for calculations. I created a new TBC project with an ISG NSW Zone 56-1 projection and the geoid "AusGeoid09". As described above, the point numbering system I adopted related to each section / workorder. As the tender won was workorder 6, the existing [redacted] control points were numbered in the 600 point series range (points 601 to 656). I imported the [redacted] provided control, placing it on layer called "CNTL – via [redacted]" thus the layer name also provided an indication of its origin. I exported the control into Google Earth, enabling me to gain an appreciation of the location of the existing control and to begin planning.
   S 4.4 ii S4.5 iv	Due to the length of the project, time constraints (due by the end of the financial year) and track closures, whereby we were not allowed on site, it was not feasible to complete the entire 23km control network and then begin setting the TCM's afterwards. Both tasks needed to be carried out in conjunction with each other. Using the Google Earth overlay, I broke the survey into several sections, taking in to account natural and physical features along the rail section such as bridge, tunnels and the indivisibility of the existing control monuments. Another consideration was to keep each section of control to manageable lengths, enabling Crew A, to performing the control survey, sufficient time to process and run the traverse through CompNET, for me to review the adjustment and

	once I was satisfied, release the control to the crews placing the TCM's and locating the track. (Crews B & C).
S2.1 i, iii	The approach I selected was to utilise RTK GPS, setting the base station on one of the existing ARTC control point's several kilometres into the project and then using RTK GPS survey techniques to search and recover each [redacted] monument. This method enabled the survey crew to navigate directly to each control monument efficiently. Once recovered, the monument was observed for 30 seconds. If the [redacted] control point was found I requested it to be coded "MOF – monument number", if the monument was not found, I requested that an observation be recorded and coded "MOX". I believe it is just as importance to discern what monument were searched and not found at the time of survey, as to which monuments were found. In the future, I hope this methodology will leave no-one guess if the monument was ever searched and thus save someone looking for it again. I also requested that all observation recorded using GPS, be
S5.1 ii	recorded by prefixing the search point number with a "5". Thence via the point number alone, I can immediately recognise that point "5642" is the GPS observed point for [redacted] control point 642. Likewise, when traversing I requested that the store points
S 2.1 ii S 6.2 ii	number begin from "100" and when traversing to a [redacted] monument prefix the existing points with a "1", thus "1642" is the observed traverse point for [redacted] control point 642. I have utilised this point numbering methodology in the past, it provides an efficient means of identifying the survey technique by which a point was observed and a correlation to which existing / search point was recovered or not found.
S 2.4 i	Star pickets 600mm in length were set with a concrete collar as intermediate survey control, in accordance with [redacted] specifications, at approximately 200m intervals. Once a section had been completed and the concrete allowed to set over night, the next step was to traverse the length of the section, using a Lecia 1 second instrument, (which had been ran over a base line prior to the project). The traverse was to carry both horizontal and vertical, therefore instrument and target heights were measured and reading of 3 rounds of angles at each traverse point.
S 3.1 iv S 2.1 iv S 4.1 i, ii S 4.2 i, ii S 4.3 i S 6.3 i-v	Once the traverse was completed, I imported the RTK GPS observed data file into TBC, using the observations to determine the reliability of the existing [redacted] control. Inversing between the [redacted] control point and the RTK GPS observed point, enable me to evaluation the published values of the [redacted] control and determine if an existing station had been disturbed, thus the monuments reliability. Where existing [redacted] was not found or was determined to be disturbed I placed the [redacted] control point on a new layer named "Disturbed – [redacted] CNTL", "Not Found – [redacted] CNTL, thus minimizing the possibility of someone using the coordinates of the disturbed control. Having determined the reliability of the [redacted] control, I could identified which existing [redacted] control points to hold in the least square computation using CompNET. The adjusted control for each section was calculated by holding [redacted] control points at either end of the section, effectively as base lines, and using the additional [redacted] control points as
S 2.4 i S 4.1 ii	brace points along the length of the traverse. I then reviewed the CompNET report and reviewed any discrepancies. On occasion that the least square adjustment failed, upon inspection the standard deviation of the observation that failed may have been out of tolerance, however because the observation was a short line, ie 20m the error ellipse equated to sub millimetre. This result is well within the tolerance of the [redacted] specifications.
S 4.4 ii S 4.5 iv	Once I was satisfied with the control adjustment for a particular section, I proceeded to export a "csv" point file for the survey crews to load into their data collectors, printed a point list and import the control points into Google Earth. The Google Earth overlay depicts the location of each control point, thus allowing a surveyor whom is not familiar with the project, to quickly and efficiently locate the required control monuments. This process was repeated six times along the 23km section of rail track. Each section was saved under the project number, within a sub folder named "Control" and another sub folder named according to the metrage that the control related to. A hard copy of the Google Earth image, point list, CompNET results and field book report were placed in the project folder.

S 1.5 ii S 3.1 i	While crew A was surveying the first section of control, I entered the Track Alignment into a software package called 12D, as TBC could not calculated NSW Cubic Parabola curves, which are used regular within track alignments in NSW. Being unfamiliar with 12D, I relied upon assistance from other staff members who were proficient with the software package and 12D support to ensure I had correctly keyed in the alignment.
S 31 ii S 5.1 ii S 2.4 i S 2.1 i S 2.1 ii	With the control network for a section established and the track alignment calculated, crews B & C were able the begin setting the TCMs at the require metrages and offsets. As several crews were involved is setting the TCM's, to create continuity amongst the crews I prepared an example "field sheet" which depicted all the appropriate information that I felt was necessary. [redacted] field procedure specifications, required that no radiation setting TCM's or track location be over 100m and the TCM be set at 2.5m offset from the "Low Rail" or intervals of 0.5m. We adhered to [redacted]'s specifications and also incorporated additional checks into our procedure, such as taking a check shots on the last TCM set from the previous setup, and the adjacent track locations. During the process of setting approximately 910 TCM's along the project, we re- setup on every control point, recorded a backsight check along with a check to the next control point, hence effectively re-traversing the entire control next work again and providing an additional check on our control network.
      S 3.1 iv S 4.1 ii	I requested that the crews download the TCM setout files at the end of each day. The following morning I would import the files into TBC and review the check observation, check that all the TCM's were placed and the adjacent track locations recorded. Each crew's daily file was divided into 3 separate layers. The layer naming convention was the "date", item of survey, (eg checks shots, TCM's, track shots) and surveyor's initials. eg "2013-05-24 – TCM –JS" This layer management technique has many advantages, but most importantly it was easy to distinguish survey items, dates, surveyors and thence the traceability of the survey information. In addition, as the project was in a remote location it allowed me to monitor the quality of the survey and it progress, to determine how many TCM's were being set per day and by whom. This information also provided valuable information for project estimation for like future projects.
S 3.1 iii S 4.5 iv S 5.1 iii	The last of the TCM's were set on the 25th of June 2013 with the final deliverables being the control, "csv" file of all TCM's and Track observation and the data collector field files being delivered on the 28th June 2013. The project was delivered on time; I also had been monitoring the project cost each Monday, after timesheets were process over the weekend, I anticipate that the project will be very close to our original fee estimate.

Registrant's Name: [redacted]

Registration No: [redacted]

Current Registration: REGISTERED SURVEYOR

Registration & Endorsement Renewal Sought:

Contact No: [redacted]

Documents included:-

EDME calibration report
Control Sketch
Control Point List
Example Field Noted
Example GPS observations

Checklist

- ☐ I have included an abstract,
- ☐ I have included documentary evidence to support the details of my CER,
- ☐ I have fully described the methodology to undertake the work including references to quality assurance procedures,
- ☐ I have mapped my work description to the competency framework elements,