Introduction

My ES Cornwall Scholarship period is currently agreed to be from March 2009 to September 2010. My proposed work program is aimed at gaining experience in alternate project management and delivery methodologies.

My initial period of employment is a 12 month period with Balfour Beatty Utility Solutions (BBUSL), commencing on the 16th February 2009.

This report is the third of six, focussing on my third period of employment from 16 August to 16 November 2009.

Commercial

Estimating

The majority of my work with estimating revolved around estimating the scheme I was developing (Salthome) and producing the respective required paperwork.

Estimating is done with input from all the relevant sections (i.e. Design, Procurement, Operations). The general methodology associated with IP2 estimates is that a bottom-up approach is applied to full IP2 schemes, while connection IP2 schemes are done using a top-down approach. All estimates developed by alliances are assured and verified by embedded NG estimators.

OHL estimating is the major estimating team within the EAE and in terms of pound value, with the split between OHL and cables varying dramatically year on year due to the inconsistent cable schemes in the workbook.

Cables are considered specialist works due to the complexity associated with route planning. Cable schemes are bespoke in nature due to numerous variable factors. Whereas initial OHL route selection is able to be done without any intrusive surveying, cables require a large amount of investigative work prior to route planning. As part of the route selection, route length must also be established so as to ensure the earthing arrangements of the cables are understood. The traditional IP2 works are not able to be confidently completed due to the extensive amount of preliminary works that must be conducted in order to understand the site restrictions and respective cable selection. As such, IP3 and detailed design works are generally conducted as part of a cable scheme's IP2 phase. Consequently, a cable schemes IP3 and DDD works require much less time to complete.

Quantity Surveying

Quantity surveying has been introduced into the Alliance to ensure the contractual obligations associated with the partnership agreement are fulfilled; primarily, cost & value reporting, pain/gain reconciliation, early warning notices and compensation events.

Cost & value reporting is established by measuring actual spend against forecast spend. The resultant pain/gain variances are reconciled to determine a forecast pain/gain for the year to date and end of financial year.

An Early Warning Notice (EWN) is established as soon as it is foreseen that a project may deviate from plan, in that it may:

1. Affect the cost of the project
2. Affect completion
3. Affect the meeting of a key date
4. Affect the ability to safely carry out the works
5. Impair the performance of the works in use
6. Affect the quality or safety of the works.

EWNs identify the extent of the impact of any unforeseen deviations from the project plan. This is done as early as possible in order to ensure the impact of the deviations can be minimised as much as possible. Subsequent to the EWN (and mitigating actions) being analysed, a compensation event may need to be developed. This effectively scopes the additional or reduced work and subsequent costs or savings. All Alliances are contractually bound to submit EWN, and subsequently report on them, as early as possible.

During my time in Estimating, I visited the Hackney cable site in central London. This job involved running 132kV cables between two substations, through an existing park. I was engaged for a short period helping develop case files for the numerous compensation events for Hackney Cables. A large number of compensation events have eventuated due to excavations encountering a very large number of unidentified underground services; the result being compensation events approaching (and at risk of exceeding) the original project cost estimates! The main reason for such a large cost overrun was due to the incomplete and inadequate investigations done prior to works commencing.

Procurement

Procurement is conducted within each alliance. NGs management of alliance procurement is done using several tools and methodologies. The major tool (UVDB) and system (Type Registration) are outlined below. Any extra efficiency that can be extracted by the respective alliance is done so, but not required.

Supplier Management

The quality of a manufacturer is managed by NG & Alliances by utilising the application Utilities Vendor Database (UVDB) & Verify, maintained by the company Achilles. Achilles identifies, evaluates and monitors UVDB members so as to ensure they meet the relevant Health, Safety Environmental and Quality standards. NG will not consider suppliers not on this database, and use the database as a manufacturer assurance tool.

Hardware/Equipment Quality Assurance

In order to deem a product fit for purpose, the use of Type Registration is employed (a process that takes anywhere from 6-12 months to complete). The type registration of an item is given when the equipment passes its respective testing (as determined by NG & Alliance Partner companies). Type registration is carried out by the respective alliance. An items Type registration is based upon manufacturer AND item AND manufacturing location. Any change in these requires re-registration.

Any new type registration is done in conjunction with NG to ensure; TCO, consistency of assets & maintenance issues are managed, along with any other requirements/tests that NG deem necessary. NG is initially contacted by the Alliance to gauge whether or not NG view a new product has potential, and as such, should be type registered. Subsequent investigations are carried out to ensure that there is true value (reduced installation costs, increased safety etc) in purchasing, installing, maintaining or performance of the items or system. The resultant report is presented to NG prior to procurement.

This results in preferred suppliers. The overhead lines and cables Alliances (Eastern & Western) are currently in the process of developing a common item & supplier ranking based upon experience and cost savings.

Purchases are currently done on a per project basis, due to the intermittency of project approvals (and hence cash flow to the Alliance). However, the desire is to have NG commit to a number/level of projects that will result in greater line of sight, and therefore possibly gain greater benefits from period contracts. A number of 3 year contracts have been implemented which are based upon percentage of total purchases. These are currently being developed into pan-alliance contracts in order to extract greater benefits.

EAE Subcontractors

Traditionally, the subcontractors engaged by the respective partner companies have been accepted by NG. However, large cost items (security, scaffolding, trackway) have gained attention and NG has questioned the value being delivered. Security is a contentious issue at the moment due to the cost. NG has requested lower pricing and after the initial engagement (and results) of the new supplier were experienced, discussions based about the basic equation of less paid has resulted in a lower quality product is a high priority!

As for pan-alliance interactions, information is exchanged on a quasi-regular basis between alliances for two benefits - possible new methods/suppliers & possible opportunities to exploit greater buying power.

EAE Procurement Strategies

Strategies such as London Metals Exchange (LME) tracking is conducted on a very basic nature. Due to the shorter timeframes allowed (from funds release from NG to required order time), the benefits that could be gained are

considered not worth pursuing in greater depth. There have only been a small number of opportunistic gains from early purchases.

Delivery (Operations)

The operations group is responsible for the resourcing and delivery of the EAE's schemes in the Delivery part of DDD (Detailed Design & Delivery). The major elements of delivery are tower strengthening, foundations, temporary works, access & rewiring.

Single Circuit Outages

The UK supergrid (transmission system) is heavily utilised, and as such, double circuit outages are exceptionally difficult to accommodate. In response to this, works such as restringing can only be conducted under single circuit outage conditions.

Prior to works commencing on the tower, it is made safe using methodology based upon the knowledge that a person is safe providing he is within the confines of the towers steel structure.

Tower jewellery is a term used to describe all the warning & identification plates on the tower. These identification plates play an important role in ensuring the tower can be made safe. Each circuit has its own unique ID plate. The ID plate is a multi-coloured pattern. Circuit ID plates are placed on the towers at 3 intervals; just above the ACD, at the '8 metre' mark, and at the lowest cross-arm.

Site works are not permitted to proceed unless a number of safety requirements are met, primarily, the work methods have been analysed and deemed to be safe. NG stipulate the use of a person that is responsible for ensuring that work is able to be done in a safe manner, away from live conductors (i.e. safety distances are maintained). The subsequent approval from NG allows for the circuit to be taken out of service.

Prior to any climbing activities, safe work on the ground areas are delineated with cones outlining potential drop zones. These zones are only to be entered by the respective climbers, and as such, if the zone is entered by anybody else, workers are instructed to cease work.

Following the setup of the ground areas; a single climber is instructed to prepare the tower. Preparation involves climbing the tower and delineating (using red flags) the safe work area on the tower.

After the safe work area is delineated, the respective conductors are earthed to the tower using flexible earths, applied using insulated poles.

When the tower has been prepared and made safe, each person who climbs the tower is issued a wristband that must be worn at all times. This wristband identifies the circuit that should be climbed and matches the circuit identifier on the tower plate. There are a predefined number of wristbands issued for

each job. On site, each wristband is accounted for prior to issuing, and upon return.

Tower Refurbishment

Tower refurbishment is preferred to tower replacement for 2 reasons; tower locations are already established, and double circuit outages (for the period required to dismantle and assemble a number of towers) are near impossible to attain on the current network.

Refurbishment is a common task that is carried out by NG Alliances. It consists of 4 major elements; tower steelwork, tower foundations, circuit insulation levels & conductor replacement.

Required Design

The required design level is meant to be defined prior to the commencement of any scheme within the Alliance (as part of the IP1 process). This document is meant to outline the aims of the scheme (e.g. increase capacity or asset replacement, fibre requirements etc). This element of the process is frequently not completed in full, and as such the lack of document is responsible for a large amount of confusion between teams.

Existing Condition

Each element requires up-to-date information regarding their initial design and current condition. Information regarding the initial design is generally difficult to determine due to poor record keeping in the past. The current condition of the towers is more easily obtainable due to respective investigations that can be performed. The common investigations that are carried out early in the design phase are tower climbing inspections (resulting in information regarding the extent of rust of the individual steelwork members, and the condition of tower accessories), intrusive foundation inspections and conductor inspections (these are done by removing a section of the conductor; usually less than one metre, and analysed to determine its condition).

Analysis/Redesign

Subsequent to the condition of the tower being ascertained, three steel elements and foundation elements are defined as part of the design process; Replacement Steel, Strengthening Steel, Technical Design Notes & Foundation designs.

Condition based replacement steelwork is carried out on a tower by tower basis.

Strengthening steelwork is done to accommodate the new tensions and weights applied to the tower due to new hardware or conductor. NG have done some initial analysis on existing tower designs to ensure that certain new conductor systems are able to be installed (and aid in IP2 works), thereby reducing the amount of bespoke analysis that may need to be done. Full load analysis is done, and strengthening methods are decided during IP3.

Strengthening is generally done by adding steel members, and either replacing or adding reinforcing steel to existing steel members.

Technical design notes are developed throughout the life of the NG assets. These notes identify weaknesses in the assets that NG deems should be modified, however, due to cost implications, should not be done in a bespoke fashion. As a result, these works are conducted in conjunction with the assets other refurbishment works.

Refurbishment Works

The physical refurbishment of the tower is almost always conducted as non-outage works due to the inherent flexibility in scheduling the works. Problems arise when replacement or strengthening steelwork is required that has the potential to fall within the safe electrical clearance distances to the conductors. In such a case, temporary structures and diversions may be required.

When steelwork installation is required to be done where it is deemed unsafe to do so during non-outage conditions; the possible use of temporary structures is examined. Temporary works are usually implemented when work on the target (to be refurbished) tower means:

1. Safety is compromised, and
2. Sufficient circuit outage durations are unattainable, and
3. Temporary works are physically able to be installed, and
4. It is cost effective

The majority of temporary structures involve the installation of temporary towers whereby circuits are transferred onto them, at a distance away from the target tower, so as to allow safe work on the target tower.

My time within Operations has been spent in Newcastle, where a number of schemes are being currently being delivered. I have been managing the subcontracted piling gangs and security. I have found that managing subcontractors, compared to company employees, is significantly more challenging due to a number of issues. The main difficulties arise primarily due to two things; the relative unfamiliarity of the expectations the subcontractor has of all workers that fall under their and the main contractors care, and the timely production of information (designs/drawings etc) from the main contractor.

A number of minor issues have been arisen due to safe behaviour on site, as well as poor site maintenance. I believe the reason behind this is primarily due to the amount of time allocated to familiarise the gangs with the expectations of BBUSL. I don't believe a 2 hour induction is adequate to fully familiarise subcontractors and embed the expectations, as bad habits seem to surface whenever stress is present.

Numerous costly delays have occurred primarily due to the lateness of designs and drawings being approved. I believe the major issue behind this is one of two things, either the lack of awareness of the consequences of the

lateness of drawings (i.e. poor or reactive management of designers) or the under resourcing of the design section; in a simple case, the drawings were scheduled to be completed 6 weeks prior to piling commencing, however they arrived 4 days after piling gangs arrived on site.

Conclusions

My short period in the commercial group highlighted the value of quantity surveyors in a project. The Early Warning Notices (EWN) that are identified and quantified allow for greater incidence management. The EWN provides for pro-active management of a project, and explains and documents the potential cost implications associated with project deviations. The associated mitigating actions can be developed, costed and analysed so as to minimise the impacts. The greatest benefit of the EWN is the foresight it provides.

The work methods utilised by the EAE allow for greater network availability, and more detailed project management. Tower refurbishment works done to increase network capacity provides greater value due to the reduction in work associated with achieving greater circuit capacity. Of particular value are the benefits associated with having greater scheduling flexibility, and as a result, greater workforce management or incidence management. Implementation of these methods requires the respective control measures to be adopted (e.g. tower jewellery) and as such, would probably require a transition methodology to be developed to allow for towers to be refurbished with single circuit outages. The benefits associated with implementing single circuit outages are numerous; however, I believe great care must be taken before any works like this should be attempted (such as operative training, and strict work methods).

I believe that the methodologies associated with refurbishment and reuse of towers is highly valuable, however, the need for these methodologies may not be immediately evident in Queensland (due to the target circuits/routes existing asset condition). The foresight and understating of the work required by an organisation prior to implementing such methods though, are valuable.

Other Work

New Engineering Contract 3 (NEC3) Workshop

The NEC3 was developed (from previous NEC versions) to address a number of identified shortcomings of previous versions; particularly to strengthen and highlight:

1. Good management procedures
2. Pro-active arrangement – stimulus for good management
3. Focus on programme
4. Flexible
5. Clear Roles & Responsibilities
6. Financial Risk Arrangements

Basic Structure

The basic structure of the NEC3 is:

- Core Clauses
- Any 1 of 6 main options
    - Any additional secondary options (as the employer requires)
- Partnering agreement (if required)

The different Main Options are:

- Option A – Priced Contract with Activity Schedule
    - Lump Sum Contract
- Option B – Price Contract with Bill of Quantities
    - Re-measurement contract
- Option C – Target Contract with Activity Schedule
    - Target price for scheme set by activity schedule
- Option D – Target Cost with Bill of Quantities
    - Variant of cost reimbursement
- Option E – Cost Reimbursable (Cost plus)
    - Paid costs plus fee
- Option F – Management Contract
    - Management of works only

There are numerous Secondary Options that may be introduced into the contract, but the most utilised is Option Z – additional conditions. Option Z is used traditionally to house the special clauses required by the employer.

Alliance Contract

The EAE contract is based upon NEC3, Option C with Partnering Agreement. The reasoning behind the selection is due primarily because the contract is:

- Less adversarial
- Suitable for long term relationships
- Open Book (Transparency)
- Encourages Teamwork & continuous improvement

Future Work

In the final 3 months with EAE, I plan on continuing my involvement within the Operations team and then finishing my time at BBUSL within their Innovation Department. The Innovation department are responsible for investigating new techniques and technology associated with all facets of BBUSL's work.