Annex

A20.17 Asset Health Unit Cost Process and Assessment

December 2019

As a part of the NGGT Business Plan Submission

nationalgrid

Executive summary

Our asset health work involves a wide range of activities, from repeatable, standard jobs with low levels of differentiating factors, through to those that are more bespoke and are therefore naturally harder to apply standard unit costs to. Regardless of where in this spectrum an activity sits, we have employed an approach that considers historical outturn information as the strongest indicator of future unit costs. Where outturn costs are not available, we have used the next set of strongest indicators which may consist of combinations of outturn costs, supplier quotations or estimation techniques.

There remains an ongoing commitment in testing, developing and honing our unit costs to improve our abilities as an Asset Manager and delivery efficiencies to the customer via continual development. As such, our unit costs figures are subject to change and we have been keen, via engagements with Ofgem, in sharing working calculations early in the process to support a transparent and constructive view of our plan.

Our approach for Asset Health has been to focus our activities on investments of £10m or greater across both RIIO-2 and RIIO-3, these investments represent 68% of the expenditure. Within RIIO-2 this has resulted in 85% of these top investments based on outturn costs, 10% on Supplier quotations and 5% estimated. Our total RIIO-2 plan is built upon 71% of the value of the plan built upon outturn costs, 15% on supplier quotations and 14% on other estimation techniques.

In developing capital schemes, we forecast costs at a very early stage using assumptions on scope and work mix (work mix is the blend of activities we expect to be required to deliver the work, such as deep vs. shallow excavation, and minor refurbishment vs. complete replacement of an asset). These assumptions allow us to apply assumed unit costs. As a capital scheme moves through our investment process, we verify these assumptions (volume, work mix and cost) through detailed survey and design work, which feeds into a competitive market tender process. As such, all our delivered programme costs are market tested prior to committing to work.

We strive to improve our ability to estimate the cost of a piece of work on our assets before any survey or design work is carried out, which in turn enhances the accuracy of our financial plans. To do that we have articulated the cost of intervention on “standard units” of assets and are building insight as we deliver programmes built up in the language of these standard units. We have categorised our assets for costing purposes into more than 300 components which are aligned to the ISO14224 standard. We have built our forecasts based on these defined components, as well as applying top down sense checks which include the use of internal and external benchmarking information. As a result, our cost forecast in our RIIO-2 plan is far better than we have ever been able to complete in the past.

We have aimed to provide a high-quality submission based on efficient unit costs. One of the key principles in developing our plan has been to start with evidencing the equivalent unit cost from RIIO-1 and overlaying the efficiencies we expect to achieve in RIIO-2. The detailed working has been extensive, and, throughout the entire process, documentation and audit trails have been maintained.

These expected RIIO-2 efficiencies included within unit costs will be further enhanced by the plan wide commitment to achieve a 4% efficiency on our baseline direct capital investments.

The availability of representative cost information for the more bespoke Gas Transmission activities is challenging, given the low number of directly relevant external reference points available to us and the limited levels of certain types of historical asset interventions.

Richmond is our asset management transformation programme. It is driving a step change in asset management capability through asset data insights, unified planning, consolidated resource management and simplification of project & cost management.

Improvements driven by our Richmond programme have enriched our available data and will capture cost data moving forward, however our historical information is not always complete or systemised. Our methodology therefore uses the best available information for each unit cost, including;

- historical outturn cost information, where we can match like for like units against delivered programmes;
- supplier quoted costs, matching like for like units against a tendered but not delivered programme of work;
- extrapolation to similar types of work or sub components of work; and
- review of industry wide benchmarking or cost data.

Estimation methodology

In 2018 we categorised our assets for costing purposes into more than 300 components, which is significantly more granular than ever previously defined. Obtaining outturn costs for each of the 300 components has proved difficult to extract from RIIO-T1 works on the basis projects were not setup to collect information at this lower level. As we move into the planning phase for RIIO-T2 works, our surveying and design methodologies will be adjusted to develop projects not only at the 300 component level but one step beyond incorporating level 6 and 7 of the ISO 14224 taxonomy.

During RIIO-T2 and in readiness for building the RIIO-T3 plan, further enhancements to the ISO taxonomy in terms of modifications and introduction of new cost differentiators (drivers) which will serve the purpose of continually honing our cost data and intelligence.

This will allow us more effectively to challenge contractor costs and hence reduce costs or gain insights into why tendered costs are different to those expected. It will also give us greater certainty of the cost of our planned investment programmes several years in advance.

Our methodology prioritises the use of historical outturn information from previously delivered programmes to establish unit cost point estimates. From sanction papers the scope associated with relevant works has been identified and a standard method developed for allocating indirect costs, taken from SAP, to create unit cost estimates by asset category (or “UID”). These unit costs are then adjusted where appropriate by overlaying efficiencies driven by new innovative techniques and policy changes to better reflect the future efficient cost of that work.

If we do not have representative historical outturn information, we look to Supplier quotations for that work, or equivalent work. Allowances are added to these quotations for NG activities such as project development including surveys, feasibility, conceptual design, project management including monitoring required by legislation during design and construction, closeout activities including commissioning and updating records, plus allowances for identified risk.

If neither outturn costs or supplier quotations are available, we disaggregate the work into sub-components and estimate cost at a more granular level based on experience of comparable activities, before reaggregating them to form an estimated unit cost.

Challenges and confidence levels

The existence of diversity in our assets types and local environment creates diversity in work mix therefore uncertainty in the calculated unit costs. An example of this is the use of prevailing compressor gas generator technology, which can give rise to a wide range of re-life costs depending on the gas generator concerned. This, coupled with a number of different environmental and geographical factors (such as corrosive environments making it difficult to predict the condition of inaccessible assets, remoteness/accessibility of assets and variance in the depth of our below ground assets), creates challenges when using historical project outturn information to predict future unit costs. Equally, as our assets age and we see more potential failure modes that we have not rectified before, estimation of the cost to resolve becomes more uncertain.

An example of these challenges is in relation to digs to investigate and rectify defects identified from In Line Inspections. The nature and length of access required to reach the pipeline defect has a highly influencing impact on the outturn cost and the temporary access / roadways required can range in cost from £1,000 to £200,000. Similarly, the depth of excavation required to reach the defect creates another set of work mix variability having a significant influence on the outturn costs. In addition, the defect found could range from nothing (i.e. anomalous data from the instrumentation used), to a significant defect requiring repair or cut out and replacement of the affected pipe section.

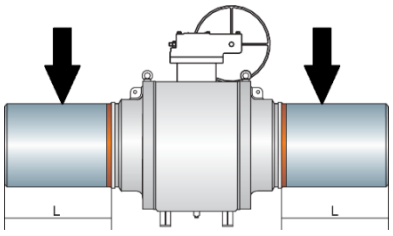
The existence of such diversity in our work mix gives rise to uncertainty in the calculated unit costs. As our assets age and we see more potential failure modes that we have not rectified before, estimation of the cost to resolve becomes more uncertain. In these instances unit cost confidence can only be improved when there are high volumes of outturn cost available to underpin meaningful cost modelling.

Innovation & Policy overlays

We need to incorporate increasing efficiencies in the forecast cost to deliver the required asset health programme due to both known innovation (that was not available at the time historical works were completed), and changes to policy we are already making in the pursuit of greater levels of whole life cost efficiency. Specific examples of such overlays include:

- Vent and sealant lines are small bore lines associated with ball valves and are essential for valve maintenance. The vent and sealant lines suffer corrosion around the wind / water line and a shallow dig methodology has been developed to facilitate the cost-effective replacement of the corroded sections of line.

- We have adopted the industry standard for Valves (V6), which removals the requirement for new valves to be fitted with transition pups (short sections of pipe pre-welded to the main body of the valve to facilitate the installation of valve and piping on site). This gives rise to a procurement cost reduction, as well as a logistical efficiency as non-pupped valves are smaller and therefore simpler to transport.



We have considered the impact of such innovation and policy changes on all UIDs, identified 64 that are impacted and made appropriate adjustments where necessary. Furthermore, we have declared future efficiencies of 4% within our asset health plans which we expect to deliver through further innovations, however we do not know specifically what those opportunities are today.

Benchmarking

To provide us with confidence that our costs are efficient and help us identify where there are better ways to deliver our work, we have been putting significant effort into creating relevant external benchmarking data.

We issued an enquiry to several external consulting organisations which included Arup, Turner and Townsend, Chandler KBS, Arcadis & DNV GL Noble with the objective of obtaining comparable unit cost data from other related industries. Arcadis were the **only respondent** with their own unit cost repository. Differences in how data has been collected and other cost differentiators between peer industries has made obtaining like for like comparisons very difficult.

We are founder members of GTBI and noting its purpose is to share best engineering practice, we asked this group to participate in a cost benchmarking exercise. We asked for outturns costs from completed projects over the past 10 years, however not all companies can provide all information. Acknowledging the limitations and constraints of the study, the findings provide more qualitative than quantitative information. Juran found it difficult to draw concrete conclusions about the unit costs observed, given the limitations and constraints of the study.

Within the National Grid group there is a US-based gas network business. This network more closely resembles a UK gas distribution network. We utilised work done in preparation for the GTBI study to explore with our US counter-parts if they could assist us. As with GTBI members it was found that the granularity and clarity of captured costs meant reasonable comparative data was not available.

To date, we have been unsuccessful in generating reasonable comparative information and as such have not been able to use this data to validate our internal unit cost assumptions with those of external parties.

External benchmarking - GTBI

We are a founding member of the Gas Transmission Benchmarking Initiative; a voluntary group of 11 pan-European Transmission System Owners who have worked for over a decade, sharing best practice to help drive efficient network operation and asset management. The group is facilitated by a benchmarking consultant, Juran, who also act to ensure confidentiality and anonymity where required by Competition Law. Noting the GTBI's purpose is to share best engineering practice, we asked this group to participate in a cost benchmarking exercise. Informal feedback from member company representatives indicated that generally they held little existing unit cost information of potential use for this exercise and that to derive unit costs across a broad range of equipment units appeared a difficult task. In addition, no other participating TSO has yet taken the step to adopt the ISO14224 standard taxonomy, meaning we are the first to adopt this leading-edge approach among our GTBI peers.

We persisted in lobbying the members and Juran for co-operation, stressing the importance of this project to our business planning for the next price control period, however only six companies agreed to participate.

After prioritising and shortlisting the information we wanted, we approached Juran with a list of 65 equipment units for which benchmarking information would be useful, and which represented 55% of our forecast expenditure over the ten-year period covering both RIIO-2 and RIIO-3. From the outset, Juran expressed the opinion that the breadth of assets and number of variables to be recorded would make running the study and reporting its results too complex. We have worked with Juran to rationalise and simplify the study

parameters, whilst trying to retain those aspects that, in our opinion, are essential if the study is to prove worthwhile. The key outputs we required were:

- unit cost information for 26 equipment units
- acceptable levels of information on cost drivers
- acceptable levels of information on cost definitions

We therefore requested cost & volume information on a total of nine equipment groups[1] which comprise a total of 26 equipment units and represent 42% of our forecast 10-year asset health plan. We asked for outturns costs from completed projects over the past 10 years, however not all companies can provide all information (each company stated in which of the groups they would provide information). We were ideally seeking 5 data points for each asset however results have fallen short of this ambition.

Acknowledging the limitations and constraints of the study, emerging findings provide more qualitative than quantitative information. Juran found it difficult to draw concrete conclusions about the unit costs observed, given the limitations and constraints of the study

The data prompts questions which can't immediately be answered, usually because of the limitations on the granularity of data acquired and the lack of full clarity on each company's costing and accounting systems.

There are several examples where a term such as 'refurbishment' is provided, but with no further granularity on the specific activities carried out. This leads to a significant potential for very different work programs being compared, giving rise to misleading results. Equally, several data items have been provided for other work types where some participants have included all necessary activities to complete the work, such as optioneering and detailed design, whereas other participants have excluded them from their submitted data. Given the level of granularity that has been provided, it is not possible to manipulate the data to make it comparable.

We intend to continue working with Juran to develop this understanding to help inform our unit costs over the coming months and years.

External benchmarking - Arcadis

In addition to the work with the GTBI, we issued an enquiry to several external consulting organisations which included Arup, Turner and Townsend, Chandler KBS, Arcadis & DNV GL Noble with the objective of obtaining comparable unit cost data from other related industries.

Arcadis were the **only respondent** with their own unit cost repository, based on outturn costs, which covered some of the asset types we were seeking. Arcadis are also familiar with the taxonomy structure of ISO14224.

Differences in how data has been collected and other cost differentiators between peer industries has made obtaining like for like comparisons very difficult. We have included a small case study in the appendix to this document to show some of the granular differences in available data in one example equipment unit. The

[1] An example of an equipment group is Cathodic Protection, which comprises four different assets (Groundbed, TR, Anode bracelet and Anode buried in proximity)

engagement with Arcadis has therefore resulted in heavily caveated data; an excerpt from their results details some of the challenges:

Permitry & Competency: NGG has strict Permitry requirements which would far exceed the requirements found in almost all the Arcadis data except for data collected from the Nuclear sector. We would also consider the demonstrable levels of competency to be higher within NGG works compared to other sectors.

Productivity: We would expect the productivity on NGG projects to be much lower due to many factors, for example, care and attention to working around high pressure gas pipelines, the small size of projects, co-ordination / restrictions from other works, maintaining access to and operability of critical national infrastructure etc

Complexity: The complexity of projects for NGG we'd consider to be higher than those in other industries due to several factors such as; design considerations, more complex works sequencing, multi-disciplined works, high proportion of specialist works etc

Location: Conveying high pressure natural gas means NGG assets are required to be situated away from populated areas and are predominantly rural. Location will therefore have an impact on the cost of materials, labour, subsistence, plant, equipment and preliminaries.

Uncertainty / Change: The predominance of NGG assets are situated below ground and date back to the early 1970's therefore the level of uncertainty in scope is much higher compared to other industries whose assets are situated above ground and possess more recent records. This is likely to increase the amount of change during works and the cost of projects.

Asset Purpose: We consider the purpose the asset serves to be important when undertaking comparisons and this has a significant bearing on specification, design life and quality and performance criteria of the asset.

We undertook further work with Arcadis to overcome some of these challenges to enhance the relevance of this data. To date, we have been unsuccessful in generating reasonable comparative information and as such have not been able to use this data to validate our internal unit cost assumptions with those of external parties.

Internal benchmarking

Around £[redacted]m a year of our maintenance and refurbishment activities are contracted to our Pipeline Maintenance Centre (PMC) business. PMC successfully provide a wide range of these services[2] to over 60 external customers, including Distribution Networks, in the UK. Most of their work is awarded through an external competitive tender process, and PMC's turnover has increased year on year since 2015 which demonstrates they are competitive.

In terms of the repair and refurbish aspects of our plan we are therefore confident that, as PMC are charging us their standard rates (less profit margin), our costs are at or below market rate creating significant value and benefit for consumers.

[2] Examples of these services include ILI Inspection & defect resolution, Aerial Survey, Line Walking & defect resolution, Welding, P11/P2 Inspection, Shot-blasting & Painting, Valve Refurbishment & Repair, Vent & Sealant refurbishment and replacement.

Appendix

Case study on data differences for Fencing

During the work with Arcadis to obtain comparable unit cost data from other related industries, we undertook a deep dive exercise on three example equipment units to better understand the potential alignment issues that were evident. The results below for one (Fencing) are taken from the results presented to us by Arcadis:

Specific Differences	Included NGG	Included Arcadis
Fence - Continuous 800mm concrete Sill along full perimeter	Y	N
Fence - Continuous concrete encapsulation of ducting along full perimeter	Y	N
Fence - Footpath on outside of fence along full perimeter	Y	N
Fence - Breakout of the existing sill and disposal to landfill	Y	N
Fence - Disposal of existing fence to landfill	Y	N
Fence - S5 fence material specification	Y	N
Fence - Posts and foundations sized to support weight of electric fence	Y	N
Fence - Non-standard fence posts to accommodate electric fence fixings	Y	N
Fence - Cross sections of fence posts double	Y	N
Fence - Number of intermediate fence posts double	Y	N
Fence - Anti-climb bars and barb wire installed	Y	N
Fence - Additional rebar reinforcement in foundations	Y	N

In summary, Arcadis conclude that "*The volume and materiality of these differences would make comparisons of unit costs unrepresentative and any attempt to do so is unlikely to result in providing any substantive insights or conclusions.*"